Fifth Annual Proceedings

· of the ·

Association of Military Surgeons

· of the ·

United States

A SELECTION OF PRACTICAL PRESCRIPTIONS

Muscular Soreness, Lagrippe Pains.
℞ Antikamnia (Genuine).
Quin. Sulph ....aa grs. xxx
Pulv. Ipecac et Opii..........grs. x
Mx. ft. Capsules No. x.
Sig.—One every two or three hours.—Buffalo Med. Jour.

Trigeminal Neuralgia.
℞ Antikamnia (Genuina).......... ʒ ij
Ext. Aconiti.....................gr. ij
Mx. ft. Caps. No. xvj.
Sig.—One every two hours as advised.—Jour. of Ophthal.

Rheumatism. (Acute.)
℞ "Antikamnia and Salol
Tablets"...............No. xx
Sig.—One every three hours.
Alternatad with
℞ "Antikamnia and Codeina
Tablets" ....No. xx
Sig.—One every threa hours.—Hot Springs Med. Jour.

Painful Dysmenorrhœa.
℞ Antikamnia (Ganui
Brom. Potass.....
Elix. Simplex....
Mx. Sig.—Two teasp
in water.—N. Y. Med.

In Painful Menstruation.
℞ Antikamnia (Genui
Atropia Sulph.....
Mx. Sig.—Give at or
if necassary.—Medical

Acute Articular Rheumat
℞ "Antikamnia, Quin
Tablets".....
Sig.—One every tv
Amer. Pract.

Hysteria. (Alcoholic.)
℞ Antikamnia (Genui
Brom. Sodii......
Elix. Ammon. Vale
Mx. Sig.—One teasp
a day.—South. Cal. Pra

Drunkard's Insomnia.
℞ Antikamnia (Genui
Bromid. Potass....
Elixir Simplex....
Mx. et Sig.—Teaspo
in water.—Practical M

Biliary and Nephretic Co
℞ "Antikamnia and
Tablets".....
Sig.—One every thre
Mass. Med. Jour.

Insomnia. (Hysterical.)
℞ "Antikamnia and
Tablets" ....
Sig.—Ona evary two hours.
P. S.—Crush tablets befora administaring.—N. Y. Med. Jour.

Pneumonia Allied with Grippal Symptoms.
℞ "Antikamnia and Codeine
Tablets" ....No. xx
Sig.—One every two to four hours.—L'Union Medicale.

Whooping Cough.
℞ Antikamnia (Genuine)........gr. xx
Syr. Tolutan.................. ℥ j
Aqua q. s....................ad ℥ ij
Mx. Sig.—Ona teaspoonful every two or threa hours.—Med. Record.

Nervous Prostration. (Malarial.)
℞ "Antikamnia and Quinina
Tablats" ....No. xxiv
Sig.—Ona, thrice daily.—Med. Harald.

Alcoholism. (Chronic.)
℞ Antikamnia (Genuine).......... ʒ ij
Tinct. Capsici.
Tinct. Nucis Vom..........aa ʒ iv
Elixir Simplax................ ℥ ij
Syr. Aurant. Cort.........q. s ℥ vj
Mx. et Sig.—Teaspoonful, in water, four times a day.—Med. World.

Uterine Contractions Leading to Abortion.
℞ "Antikamnia and Codeine
Tablets" ....No. xxiv
Sig.—One as indicated.—Annals of Gynæcol.

Treatment of Colds.
℞ Antikamnia (Genuine).
Salol.
Sulph. Quinia.
Terpin Hydrate.........aa grs. xxiv
Mx. ft. Capsules xii. One every four hours.—Virginia Med. Monthly.

Nervous Headache. (Chronic.)

℞ Antikamnia (Genuine).......... ʒ j
Dover's Powder...............gr. xx
Mx.—Make capsules No. xij.
Sig.—Two once in two hours, until easy.—Medical Bulletin.

Pain in Grip, Influenza, etc.
℞ Antikamnia (Genuine).......... ʒ j
Salol....................... ʒ ss
Quinia Sulph..............grs. xxiv
Spts. Vin. Gall......... .. ℥ ij
Mx. Sig.—Teaspoonful evary two hours.—Maryland Med. Journal.

Depression. (From Opium Habit.)
℞ Antikamnia (Genuine).... .... ʒ ij
Tinct. Capsici................ ʒ ss
Con. Tinct. Aven. Sat........ ℥ j
Elixir Brom. Potass. q s..... ℥ viij
Mx. et. Sig.—Teaspoonful four to six times daily.—N. Y. Polyclinic.

Migraine, Headache, etc.
℞ Antikamnia (Genuine).... .... ʒ j
Potassi Brom................ ʒ i
Sacch. Alb.................. ʒ
Mx. ft. Cht. No. xij.
Sig.—Take one every two hours.—Med. and Surg. Jour.

Night Sweats of Pulmonary Tuberculosis.
℞ Antikamnia (Ganuine).
Zinci Sulph....... .....aa gr. xxx
Ext. Hyoscyam...... ....gr.
Ext. Nucis Vom..............gr. ii
Mx. ft. Caps. No. x.
Sig.—Take at bed-time.—Lancet.

Pneumonia, Especially with Restlessness.
℞ Antikamnia (Genuine)........gr. vj
Syrup Doveri... .... ʒ j
Tinct. Digitalis ....gtt. iv
Repeat every three to six hours.—Occidental Medical Times.

Threatened Abortion—Ovarian Neuralgia.
nia (Genuine).........gr. v
. Viburnum Prun....... ʒ j
Sulph...............gr. I-8
—Repeat in three or four
Gynæcol. Jour.

matism and Neuralgia.
nia (Genuine).
id. Salicyl...........aa ʒ j
p. No. xx.
four a day.—Leonard's
led. Journal.

From Mental Strain.)
nia (Genuine).
Brom..............aa ʒ i
art No. xx.
powder half an hour before
Y. Med. Jour.

algia, Rheumatism.
nia (Genuine).......... ʒ i
uinia. ....gr. xxiv
orph....... .... gr. j
hart No. x. As required.—
egister.

a when Menorrhagia Coexists.
nia (Genuine).......... ʒ ij
t. No. xij.
every three hours.—Medi-

h of Drunkards.
nnia and Quinine
lets"........... . No. 24
every two or thrae hours.—
r. Inebriety.

r, Ague, etc.
nnia and Quinina
lets"............ No. xxiv
every three hours as occasion requires.—Med. News.

Nervous Depression. (Alcoholic.)
℞ Antikamnia (Genuine).
Tinct. Capsici..............aa ʒ ij
Tinct. Cinchon. Comp. q. s... ℥ iv
Mx. et Sig.—Teaspoonful three times daily.—Jour. Nervous Diseases.

Vomiting of Pregnancy.
℞ Antikamnia (Genuine).......... ʒ j
Cocaina Mur..................gr. j
Mx. ft. Caps. No. x.
Sig.—Ona capsule every three or four hours.—Amer. Gynæcol. Jour.

Pains Preceding Labor.
℞ "Antikamnia and Codaine
Tablets"..............No. xv
Sig.—One as directed.—Amar. Surg. and Gynæcol.

EARHART & RICHARDSON
ENGRAVERS
PRINTERS
CINCINNATI, O.

☞ For "PRACTICAL PRESCRIPTIONS," see 2nd Cover Page.

PROCEEDINGS

OF THE

FIFTH ANNUAL MEETING

OF THE

Association of Military Surgeons

OF THE

UNITED STATES.

HELD AT BUFFALO, N. Y.

MAY 21, 22 AND 23, 1895.

CINCINNATI:
EARHART & RICHARDSON, SUPERIOR PRINTERS.
1896.

Officers and Committees

of the

ASSOCIATION OF MILITARY SURGEONS

of the

UNITED STATES.

. . . . For 1895 and 1896 . . . .

President,
Colonel Louis W. Read, Surgeon-General, Pa.,
Norristown, Pa.

First Vice-President,
Medical Director A. L. Gihon, U. S. N.,
Washington, D. C.

Second Vice-President,
Colonel Charles H. Alden, U. S. A.,
Washington, D. C.

Secretary,
Lt.-Col. Eustathius Chancellor, Medical Director, N. G. Mo.,
St. Louis, Mo.

Treasurer,
Major L. C. Carr, Surgeon, O. N. G.,
Cincinnati, Ohio.

Editor,
Major P. F. Harvey, Surgeon, U. S. A.,
Plattsburgh Barracks, N. Y.

STANDING COMMITTEES.

I. EXECUTIVE COMMITTEE.

President, First Vice-President, Second Vice-President, Secretary, Treasurer, and Editor.
Brig.-General Joseph D. Bryant, N. G. N. Y., New York City, New York.
Brig.-General Edward J. Forster, M. V. M., Boston, Mass.
Lt.-Colonel Charles M. Woodward, N. G. Mich., Tecumseh, Mich.
Major Alfred C. Girard, U. S. Army, Fort Sheridan, Ill.
Major Albert H. Briggs, N. G. N. Y., Buffalo, N. Y.

Colonel Nicholas Senn, N. G. Ill., Chicago, Ill., ex-President.
Brig.-General George M. Sternberg, U. S. Army, Washington, D. C., ex-Pres't.

Standing Committees.—Continued.

2. PUBLICATION COMMITTEE.

Brig.-General Jefferson D. Griffith, N. G. Mo., Kansas City, Mo.
Major Philip F. Harvey, U. S. Army, Plattsburgh, N. Y.
Captain Myles Standish, M. V. M., Boston, Mass.

3. LITERARY COMMITTEE.

Colonel Dallas Bache, U. S. Army, Omaha, Neb.
Lt.-Colonel Charles W. Myers, N. G. N. J., Patterson, N. J.
Surgeon John C. Boyd, U. S. Navy, Washington, D. C.
Captain J. J. Erwin, N. G. O., Cleveland, Ohio.
Lieutenant H. L. Chase, M. V. M., Brookline, Mass.

4. NOMINATING COMMITTEE.

To be designated at time of meeting.

SPECIAL COMMITTEES.

ON OFFICIAL RECOGNITION OF BADGE.

Major John Van R. Hoff, U. S. Army, Governor's Island, N. Y.
Major Theodore W. Evans, N. G. Wis., Madison, Wis.
Captain Edward O. Meyer, N. G. N. Y., Buffalo, N. Y.

ON CREDENTIALS.

Major George Henderson, N. G. D. C., Washington, D. C.
Lieutenant Lawrence S. Smith, N. G. Pa., Philadelphia, Pa.
Lieutenant George H. Haberstadt, N. G. Pa., Pottsville, Pa.

ON NECROLOGY.

Brig.-General George A. Bowen, N. G. Conn., Woodstock, Conn.
Colonel Clayton Parkhill, N. G. Col., Denver, Col.
Major Thomas C. Clark, N. G. Minn., Stillwater, Minn.

AUDTITING COMMITTEE.

To be appointed at time of meeting.

LOCAL COMMITTEE OF ARRANGEMENTS.

Major J. Wilkes O'Neill, N. G. Pa., 38 S. 19th Street, Philadelphia, Pa., with authority to appoint Associates and arrange Sub-Committees.

Chairman of Reception Committee—Major Joseph K. Weaver, Surgeon, N. G. Pa., Norristown.

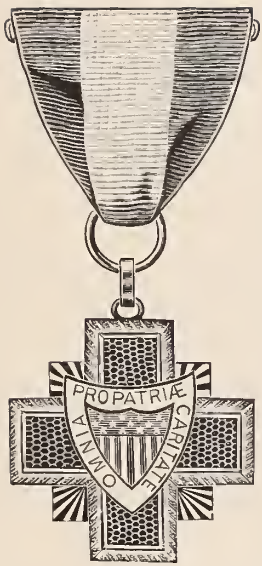
Association of Military Surgeons

of the

United States.

Fifth Annual Session.

Official Minutes of the Proceedings.


PRO PATRIÆ
OMNIA CARITATE

SILVER SHIELD PRESENTED TO SURGEON-GENERAL NICHOLAS SENN.

SEE PAGE 27.

Proceedings of the Fifth Annual Meeting

OF THE

Association of Military Surgeons

OF THE UNITED STATES,

HELD AT

BUFFALO, N. Y., MAY 21, 22, AND 23, 1895.

FIRST DAY—MORNING SESSION.

PROGRAMME.

Prayer by the Rev. William C. Wilbor.

Address of welcome on behalf of the State of New York, by Hon. Sherman S. Rogers.

Address of welcome to Buffalo, by Major Edgar B. Jewett.

Address of welcome, by Roswell Park, M. D., on behalf of the medical profession.

Address of welcome, by Col. Geo. C. Fox, on behalf of the National Guard.

President's Alumnal Address, by Brig.-Gen. George M. Sternberg, Surgeon-General, U. S. Army, President of the Association.

OFFICIAL MINUTES OF THE PROCEEDINGS.

The opening meeting of the Fifth Annual Session of the Association of Military Surgeons of the United States, was held in the Star Theater, Buffalo, N. Y., Tuesday morning, May 21st, 1895.

After an overture had been played by the orchestra of the 65th Regiment, N. G. N. Y., prayer was offered by Rev. William C. Wilbor.

Major Albert H. Briggs, Chairman of the Buffalo Committee of Arrangements, then introduced Hon. Sherman S. Rogers, of Buffalo, who said:

GENTLEMEN:

In the absence of Governor Morton I have been charged with the agreeable duty of extending to this Association the respectful and cordial welcome of the State of New York. I have been instructed to say that the Governor very greatly regrets his inability to attend in person, and to testify to this Association the deep interest which he has in the objects for which it has been called, to express to all the members the earnest hope that the meeting of this Association may not only be personally pleasant to them, but that it will be productive of very great good.

It is gratifying, gentlemen, to note that while the resources of science are constantly coming more and more to the aid of the destructive work of war, making it more severe and certain, and terrible, that they are also coming to the relief of the victims of war. The State of New York remembers, with unavailing grief, that thousands of her brave sons have laid down their lives under circumstances which, in the present condition of military medical and surgical science, would have insured their recovery and their preservation to a grateful country.

New York is proud of her National Guard. It is composed of patriotic young men, who desire to serve the State as soldiers, and who are fast becoming true soldiers, soldiers upon whom not only the State, but the country, may rely in troublous times. It already owes a great debt to its National Guard. The country recognizes, and ought to recognize, the duty which lies upon it to provide amply for their health and for their soldierly comfort.

But, gentlemen, while the studies of your Association are primarily directed chiefly to military science, to military medicines, hygiene, and surgery, the results of those studies extend over a far wider field. The victories of this Association are victories of peace as well as of war. Its succor comes not merely to soldiers, but to every officer and private in the great army of peace; in fact, to all who are subject to casualty and to disease; and it is for this reason that you are doubly welcome in this State, and that we now extend

to you a most cordial and hearty welcome, and trust that you may find your stay in this commonwealth, and in this city, most agreeable and most profitable.

A cordial and hospitable welcome to Buffalo was extended by the Mayor, Gen. Edgar B. Jewett, on behalf of the city; by Roswell Park, M. D., on behalf of the medical profession, and by Col. George C. Fox, of the 74th Regiment, N. G. N. Y., on behalf of the National Guard.

In response, President Sternberg said:

GENTLEMEN OF THE ASSOCIATION OF MILITARY SURGEONS, LADIES AND GENTLEMEN:

Before reading my address it becomes my very agreeable duty to acknowledge the courteous and cordial welcome which we have received from Hon. Sherman S. Rogers, as representing His Excellency, the Governor of this great State; from his Honor, the Mayor; from Dr. Park, as representing the medical profession of the State of New York, and from Col. Fox, representing the local National Guard, and to express our very great obligation for the courtesy shown us, for the cordial greeting which we have had, and also our very sincere thanks to the gentlemen of the local committee, Maj. Briggs and the gentlemen associated with him, for the very satisfactory preparations which have been made for the success of this meeting. It was especially agreeable to me when I learned in Washington, last year, that it had been decided that this meeting should be held in Buffalo. I am a Buffalo boy myself, to some extent. I came here when quite a small boy—as you may imagine when I tell you that I came on a packet on the Erie Canal; and it was the day when those packets were considered pretty fine vessels, too. And, as a boy, seven or eight years of age, I learned my reading, writing, and arithmetic in one of the public schools of Buffalo. I remember, also, with a great deal of pleasure, that I received the first prize which I ever received as a school boy here. It was not for my accomplishments in reading, or writing, or arithmetic, but for "being a good boy." You know the popular idea is that good boys don't

live long, and, therefore, the supposition is that that did not last. [Laughter.] I read a story the other day about a good boy. His mother said to him, "Now, Johnny, you must be a very good boy to-day." He hesitated a little, and thought the matter over, and then he said: "Mamma, if I am a very good boy to-day may I be a bad boy to-morrow?" [Laughter.] So that I am not pluming myself on that particular prize. I simply mention it as a fact which has remained in my memory as a very pleasant recollection.

President Sternberg then called Vice-President Albert L. Gihon to the chair, and read his presidential address:

ADDRESS OF PRESIDENT STERNBERG.

GENTLEMEN:

When you did me the honor to elect me President of the Association of Military Surgeons of the United States, I accepted without hesitation, for the reason that a declination on my part might have been ascribed to want of interest in the organization and its objects. But for two reasons, which I shall mention, I should have preferred that your choice might have fallen upon some other member. The first is, that among the members of the Association are a number of gentlemen who have claims to that honor in every way superior to my own, inasmuch as I am a new member, and have had no part in building up the vigorous and useful organization over which I am called upon to preside. The second is, that I was well aware that the preparation of an address suitable for this occasion would be a tax upon my time, which I could not well afford; and, as a matter of fact, I have been so much occupied by the duties of my office, and in the completion of a literary undertaking, which has absorbed every spare moment of my time for several months past, that the writing of my presidential address has, of necessity, been postponed to the last moment. I feel that in justice to you and to myself I should have had more time for the preparation of an address, and this feeling is intensified by a perusal of the admirable presidential addresses of my distinguished predecessor in office, Surgeon-General Senn. Moreover, upon looking through the volumes containing the papers read at the four annual meetings of the Association which have been held, I find that the subjects which I should have selected by prefer-

ence, have already been considered in an able and comprehensive manner by various members of the Association.

But, although, for the reasons mentioned, I think you would have done well to select some other member as your presiding officer, I am glad to be here and to have an opportunity to testify as to my interest in the objects of the Association; my appreciation of the wisdom and patriotism of its founders; and my belief that it has before it a future of usefulness and honor. Not the least of the advantages which it offers to military surgeons in the service of the Nation and of the several States is the opportunity if affords us for getting acquainted with each other, and for comparing notes as to the best methods of accomplishing the purposes which we all have in view. In time of peace many of the surgeons who hold commissions in the National Guard have opportunities for the practice of surgery far superior to those enjoyed by army and navy surgeons; and we have much to gain in the way of practical surgical knowledge from the papers and discussions relating to new methods of operating and of treating surgical injuries. On the other hand, those of us who have had experience in the field during the Civil War, or in campaigns against hostile Indians, should be better informed as to difficulties connected with the immediate care of the wounded upon the field of battle, and the practicability of applying aseptic or antiseptic methods in the treatment of gunshot injuries received in actual warfare; in questions relating to the transportation of the wounded, camp hygiene, field-hospital administration, etc. But all of these subjects are of equal interest to the medical officers of the State and the National service; for the object of the military organizations to which we belong is the same, and if a war of any magnitude should become necessary to defend the National honor against foreign foes, or to suppress lawlessness within our boundaries, the Regular Army and the National Guard would fight shoulder to shoulder, and the responsibility of caring for the sick and wounded would be shared by the medical officers of the National and State troops. That we may be fully prepared for this responsibility, and that the unfortunate victims of our next war may receive that prompt aud skillful treatment to which they are justly entitled, and which every sentiment of humanity and patriotism should impel us to give them, is one of the objects we have in view. Another,

equally important, is the preservation to the fighting ranks of as many men as possible by the sanitary supervision of camps and the enforcement of those measures known to preventive medicine, by which the various epidemic camp diseases, which have so often been a potent factor in the defeat of armies, may be avoided. Evidently, to accomplish these objects, we must have medical officers who are not only well informed physicians and skillful surgeons, but who have been specially trained for the military service. Every argument which can be advanced in favor of the military training, in time of peace, of those officers and enlisted men who are expected to defend the interests and honor of the country in case of war, applies with equal force to the special training of medical officers and sanitary soldiers. Their services are no less important and necessary; and, by properly-directed efforts for the sanitary well-being of the troops, they may materially aid in the success of a campaign.

While all this appears to us to be beyond question, it is unfortunately true that many persons not connected with the military service, including not a few who are called upon to legislate for the Army and Navy of the United States, or for the National Guard in the several States, fail to recognize any necessity for the special training referred to, and imagine that in case of need the sick and wounded of our armies would be well cared for by the practicing physicians and surgeons of the country, whose patriotism could no doubt be depended upon to supply such service as they would be able to render. In support of this view, we are reminded of the efficient services rendered during our last war by new levies of troops with their inexperienced line and staff officers. But it is precisely from our war experience that I would draw a lesson for the future. We did in the end succeed in saving the Union and preserving this Nation for its great destiny, and no necessary sacrifice was too great for the accomplishment of this end. But, alas! how great was the unnecessary sacrifice of life and treasure? The blundering and disorganization, which occurred in some of the earlier battles of the war, would have been largely avoided if the officers and men of our volunteer army had had previous military training; and the loss of life from camp diseases and traumatic infections would have been far less if the sanitary knowledge available at that time had been intelligently applied by medical officers trained for the service, and if a

well-organized ambulance corps had been always on hand to give prompt attention to the wounded.

It is true that, as the war progressed, our brave volunteers became veterans, unsurpassed in their ability to endure the hardships of a campaign or in their steadfastness under fire. And, also, that many of the experienced medical officers attached to volunteer regiments were in every way the peers of the experienced medical officers of the regular service. Indeed, most of us who passed through the war, and who are still on the active list of the army, had no more special training than had the surgeons and assistant surgeons in the volunteer service; and we had to obtain our knowledge of military life, and of the duties and responsibilities of a medical officer, in the school of actual field service. Without doubt, the lessons of experience are most valuable, but they are often very expensive, and what has been once learned in this way should serve not only for the instruction of the individual, but of those who are likely to be placed under similar circumstances. At the outset of our Civil War, a majority of the medical officers who went into the field with troops were not only without personal camp and battle-field experience, but without special instruction based upon the experience of previous wars. Among others I found myself, at twenty-three years of age, and with a commission less than three months' old, accompanying a battalion of regular infantry at a double quick in the direction of the heavy artillery firing which announced the commencement of the battle of Bull Run.

Fifteen years before, as a school boy in one of the public schools of this good city of Buffalo, I learned the following verses, which my memory has retained through all these years, although I have never seen them in print:

> "My father was a farmer good, with corn, and beef, in plenty,
> I mowed, and hoed, and held the plow, and longed for one and twenty.
> For I had quite a martial turn, and scorned the lowing cattle,
> I wished to wear a uniform, hear drums, and see a battle.
> My birthday came; my father urged, but stoutly I resisted;
> My sister wept, my mother prayed—but off I went and listed.
> They marched me on through wet and dry, the tunes more loud than charming,
> And lugging knapsack, box and gun, was harder work than farming.
> The foe came on, the battle raged, the crimson tide was flowing,
> A thousand death-groans filled my ears—I wished that I was mowing."

I did not commit these lines to memory because I had a special *penchant* for the military service, but because the class of boys to which I belonged was taught to sing them in unison, and I little suspected that the picture of a battle field brought up by the last verse quoted would, within a few years, become for me a reality. I venture upon these personal reminiscences for the purpose of illustrating the fact that we can not forecast the future; and when I remember that the United States has been engaged in two wars within my own recollection, I am not disposed to rely upon the assumption of the optimists who imagine that our wars are ended, and that we may safely fashion our swords into pruning hooks. At all events, so long as the nations of the earth continue to manufacture the weapons of war, and to place them in the hands of men who are trained to use them with the greatest possible destructive effect, it will be our duty to prepare ourselves for the emergencies of the battle field, and for the care of the sick and wounded who may be dependent upon us for such aid as medical science and surgical skill is able to give them.

This brings me to speak of first aid to the wounded. The popular idea, both with soldiers and citizens, is that when a man is shot he requires the services of a surgeon at once; and when I went upon the field of battle at Bull Run, and later in other engagements, I was impressed with the idea that I must be close to the firing line for the purpose of giving prompt assistance to the wounded as they fell. It is true that the wounded should be removed as promptly as possible from the firing line to the first dressing station, but my experience leads me to believe that there will be little opportunity for rendering surgical assistance sooner than this, and that comparatively few will require it. When large arteries have been severed, fatal hemorrhage is likely to occur before the surgeon reaches the case; and hemorrhage from arteries in the extremities should be promptly arrested by the application of a field tourniquet, if at hand, or by an extemporized tourniquet, such as every hospital corps private should be competent to apply. In attempting to recall my personal experience upon the battle field, I am impressed by the fact that I was very rarely called upon to apply a tourniquet for the arrest of hemorrhage, and that the assistance I was able to render the wounded could, for the most part, have been given by in-

telligent and well-trained enlisted men. At Bull Run I went to the battle field mounted, with the members of the band as stretcher bearers, and an ambulance belonging to the battalion with which I was on duty. I was soon obliged to dismount, for the purpose of personally superintending the placing of the wounded in the ambulance, as my assistants were entirely untrained. Finding that my horse was an incumbrance, and as I had no one whose services could be spared for the purpose of looking after him, I tied him to a tree, and unless some one else took him away he is still there, for I have never seen him since. You will pardon me, perhaps, if I introduce here an extract from my official report relating to this first battle of the war, for the purpose of illustrating the unfortunate conditions which may result from the want of an organized service for the care of the wounded:

"The fight continued until between three and four o'clock in the afternoon, when our troops began to give way, and were soon in full retreat. I followed the retreating army as far as Sedley Church, where I found nearly three hundred of our wounded, and determined to remain. Several medical officers of volunteer regiments also remained at this place. We at once raised a white flag, and commenced doing what we could for the wounded. Shortly after the last of our troops passed the church, a company of the enemy's cavalry rode up and took possession. The following morning a cold rain commenced, which continued almost without intermission for two days. The church would not hold all of our wounded, and many were lying around in front of it. I obtained a detail of men from the commander of the cavalry troop to erect a shelter. We made a frame, about thirty feet in length by twenty in width, and covered it with rubber blankets, great numbers of which had been left on the road by our men in their retreat. A number of capital operations were performed at the church, but, owing to the want of food and stimulants, and to the unfavorable circumstances under which the men were placed, most of these cases terminated fatally within twenty-four hours. On Monday, July 22d, a small quantity of corn meal was obtained from a house near the church, and some gruel was made. A cup of this was given to nearly every man, and this was all the food we were able to obtain for them till Monday evening, when all the medical officers were taken from Sedley Church to Manassas. How the wounded fared after we were taken from them I do not know. At Manassas we were lodged in a barn, with some thirty or forty other prisoners—officers and privates—under guard.

At Sedley Church there was no organization for the care of the wounded, but those of us who had voluntarily remained with them rendered such service as we thought fit, aiding each other in operations, or acting upon our independent judgment, as seemed best to us. We had a few enlisted men as

volunteer assistants, and one poor woman from Minnesota, who had followed her husband's regiment, and who was now a widow, but who bravely devoted herself to the survivors of the battle. Under these circumstances, questions relating to food and shelter for the wounded men lying around under the trees were quite as important as those relating to the amputation of limbs or the extraction of bullets. It is not necessary to dwell longer upon this sad picture, but to complete it we must recall the sufferings of the wounded, who remained where they had fallen for two or three days after the battle, exposed to a cold rain, and whose wounds, when at last the survivors were brought to the shelter of the railroad shed at Manassas, were swarming with maggots."

To reduce to a minimum the sufferings of the unfortunate victims of war, to restore to the ranks those who are temporarily disabled, and to their homes those who are unable to resume their military duties, is our humane mission. Keeping these objects in view, let us continue to insist upon the necessity for a well-trained corps of sanitary soldiers, and that our medical officers, whether of the National Guard or of the regular service, shall be not only competent physicians and surgeons, but officers who are well instructed as to their duties and responsibilities.

This will be all the more necessary in future wars, on account of the improvements in firearms which have been made in recent years; as a result of which, military surgeons will be called upon to meet new conditions. The extremely long range of the modern military rifle, and the small caliber of the bullet employed, have introduced new elements for our consideration, and it is generally believed that large numbers of men will be disabled within comparatively brief periods of time, and that a smaller proportion of those who are struck by these missiles will be killed outright, and, consequently, that a larger proportion will require surgical attention and transportation from the field of battle. How we can best meet these new conditions is too broad a theme for a presidential address. It includes a careful consideration of various topics which have already been discussed in an interesting manner in papers read before this Association, and which will engage our attention at the present and at future meetings. Among these, I may mention as most worthy of your attention: The organization of the sanitary service, with a view to attaining the best results in camp, on the march, and upon the field of battle; the best location for first-dressing stations and

for field hospitals; the best means of transportation, and the construction of litters, travois, and wheeled transports for the wounded; the best methods for the aseptic or antiseptic treatment of gunshot wounds, and the practicability of applying these methods upon the field of battle; the best operations, having in view the conditions under which these operations must be done, and the future usefulness of artificial appliances.

The medical officers who care for the wounded in future battles will not only be called upon to give their attention to larger numbers of wounded men, but in their efforts to give these men the advantage of the most successful methods of treatment, they will have to devote much more time to individual cases than was thought necessary during our last war. The attempt to secure primary union in gunshot flesh wounds, if experience proves this to be good practice; the carrying out of strict aseptic or antiseptic methods, if this proves to be practicable; the careful work required in laparotomies, undertaken for the suture of wounds of the intestine, which were formerly considered beyond surgical relief, will all take much time. And a larger medical staff, in proportion to the fighting force, would be required were it not for the fact that we hope to reap great advantages from the superior training of our medical officers, from a well-considered organization of the ambulance service, and from the efficient services of a trained body of sanitary soldiers who will, to a great extent, replace the medical officers of our last war in rendering first aid to the wounded.

At this point I think it well to introduce for your consideration some figures relating to sickness and mortality in our armies during the Civil War, and to the number and results of surgical operations performed, in order that you may judge of the amount of work thrown upon the medical department of the army in a war of such magnitude:

The total number of cases recorded in reports of sick and wounded was 5,825,480, with a total mortality of 166,623. The total number of gunshot wounds was 230,018, with a mortality of 32,907. (The total number killed in battle was 42,724.) The total number of deaths from disease was 157,004, the principal causes of mortality being: Typhoid fever, 27,056 + typho-malarial fever, 4,059 = 31,115; chronic diarrhea, 27,558; inflammation of lungs,

14,738; consumption, 5,286; small-pox, 4,717; measles, 4,246; acute dysentery, 4,084; chronic dysentery, 3,229; remittent fever, 3,853. No doubt many of the deaths attributed to "remittent fevers" were, in fact, due to typhoid infection, which in this war, as in many of those which preceded it, proved to be nearly as fatal to the troops engaged as the bullets of the enemy.

TABLE

SHOWING THE NUMBER OF AMPUTATIONS AND EXCISIONS OF THE EXTREMITIES DURING THE WAR OF THE REBELLION AND THE PERIOD 1866–1891, WITH PERCENTAGES OF MORTALITY.

UPPER EXTREMITY.

	During the War.		Since the War.	
	Number of Cases.	Percentage of Mortality.	Number of Cases.	Percentage of Mortality.
AMPUTATIONS:				
Shoulder,	852	28.5	7	14.3
Arm,	5,456	23.6	62	19.4
Elbow,	36	8.4	1	...
Forearm,	1,747	13.9	57	8.8
Wrist,	68	10.6	10	....
Fingers, with or without metacarpals,	7,842	2.6	830	.1
Total,	*1,601	....	967	....
EXCISIONS:				
Clavicle or scapula, partial,	80	2.7	1	....
Shoulder,	885	34.8	5	20.0
Humerus,	696	28.5	11	....
Elbow,	626	23.7	5	20.0
Bones of forearm,	986	11.2	7	....
Wrist,	96	15.6	1	....
In hand,	116	8.6	22	4.5
Total,	3,485	....	52	....

LOWER EXTREMITY.

	During the War.		Since the War.	
	Number of Cases.	Percentage of Mortality.	Number of Cases.	Percentage of Mortality.
Amputations:				
Hip,	66	83.3	4	75.0
Thigh,	6,229	53.8	63	41.3
Knee,	189	56.6	7	....
Leg,	5,452	32.9	87	20.7
Ankle,	161	25.1	21	9.5
Partial, of foot,	1,518	5.7	182	....
Total,	*13,615	....	364	....
Excisions:				
Hip,	66	88.6	6	33.3
Femur,	175	69.4	3	33.3
Knee,	57	81.4	....	....
Bones of Leg,	387	28.2	6	16.7
Ankle,	33	29.0	3	....
Bones of foot,	97	19.3	6	....
Total,	815	....	24	....

* In addition to the amputations reported above as performed for gunshot fracture during the War, there were 583 amputations of parts of the lower extremity, with a mortality of 25.5 per cent., and 195 of the upper, with 10 per cent. mortality on account of extensive flesh wounds, in which the fatality was due mainly to shock.

Having considered these figures, which convey to our minds, in a feeble way, an idea of the amount of suffering endured by the victims of this war, on one side only, we can not fail to ask ourselves to what extent the percentage of sickness and death from the various causes mentioned can be reduced, through our efforts, in future wars. There can be no doubt that the intelligent application of sanitary and surgical knowledge, which has been gained since the time to which the figures we have given relate, will very greatly diminish the amount of sickness and the mortality from camp typhoid and the various forms of intestinal flux which have heretofore been so prevalent among new levies of troops, and also from those traumatic infectious diseases which formerly contributed so largely to the mortality lists of armies. The extent to which this may be accomplished will depend largely upon the preparation we make in advance for

meeting these emergencies of active campaigns, and upon the success we have in obtaining the intelligent co-operation of officers in command of troops in carrying out the sanitary recommendations we may make.

The attention of military surgeons, as you know, has recently been drawn to the question of the comparative severity of wounds made by the large conical, leaden bullets formerly in use, and the small-caliber, elongated and jacketed bullet which is projected from the modern rifle with an enormous velocity, and has an effective range of more than 4,000 yards, equal to two and one-quarter miles. Recently, experiments have been made by the Ordnance Department with the Hebler tubular bullet, adapted to the .30 caliber magazine rifle. "The bullet weighs 104 grains, and is made entirely of steel, except the narrow, copper, rotating band around the middle. The sabot, on the rear end, is made of vulcanized fiber, weighing only a few grains; its only purpose is to seal the escape of gas, and it falls away from the projectile after leaving the muzzle of the gun. Prof. Hebler estimated that with a bullet of this form and construction the initial velocity to be obtained in the .30 caliber rifle would be about 3,000 feet per second, with a pressure of about 40,000 pounds per square inch, provided perfect combustion of the powder be secured by using a powder of properly regulated size of grain. The results actually obtained in these respects were secured by using the most available smokeless powder at hand, viz., an initial velocity of over 3,100 feet per second, with a pressure of about 46,000 pounds per square inch, using a charge of forty-two grains of Leonard J powder." The experiments made show that at 500 meters this tubular bullet still has a velocity of 1,556 feet per second, while the solid service bullet, starting with a muzzle velocity of 2,021 feet per second, has a velocity of 1,101 feet; at 2,500 meters the velocity of the tubular bullet is about the same as that of the solid service bullet of the same caliber, viz., 364 feet per second for the first named, and 368 feet for the service bullet. Notwithstanding the enormous muzzle velocity obtained with the tubular bullet the experiments made indicate that it is not likely to supplant the solid service bullet, having a cupro-nickeled steel jacket, and, for the present, it will not be necessary to discuss the special characters of wounds inflicted by an elongated tubular bullet. Indeed, we have, so far as

I know, no experimental data to serve as a basis for such a discussion, with the exception of the statement of the Chief of Ordnance, in his last annual report that: "Fired into well-seasoned oak, across the grain, at a range of three feet, the penetrations are seven inches for the tubular and sixteen and one-half for the service bullet. This, it appears, must be chiefly attributed to deformation and great deflection of the light bullet in penetrating the hard oak with very high velocity." The deformation and great deflection observed when the tubular bullet is fired into oak would no doubt be important factors in determining the character of wounds made by the same bullet. In discussing the comparative value of the two bullets, from a military point of view, the Chief of Ordnance says:

"The tubular bullet is at a marked disadvantage as compared with the service bullet with respect to accuracy; the trials are too limited, however, to draw a definite conclusion on this point. But, contrary to anticipation, as derived from reports of trials made elsewhere, it is also found to suffer greater retardation from the air than the service bullet, since the velocity falls off more rapidly. The velocities of the two bullets become equal at about 2,700 yards. The projectile energies and the penetrative power of the two become equal at about 450 yards; short of this distance the penetration of the tubular bullet should be greater, and at longer ranges should be less (with a diminishing ratio) than that of the service bullet.

"The light weight of this tubular bullet makes it doubtful if the shock would be sufficient for military use. The advantages which may be claimed for it are: Weight of cartridge, as enabling an increase of about 40 per cent in the number carried per man; and flatness of the trajectory, with its accompanying increase of danger space; a material increase of range for the same elevation, or, conversely, a diminished height of rear sight needed to attain useful ranges. And it is probable that, including the important question of powder pressure, these advantages can be secured better with a tubular (quasi sub-caliber) bullet than with a solid bullet of smaller caliber and equal weight, since the powder pressure must be increased as the caliber is diminished."

The character of the wounds inflicted by the elongated and jacketed bullet of small caliber has been ably discussed by members of this Association, upon the basis of actual experiment, and has received the attention of medical officers belonging to various European armies. The experiments made have developed the fact that at short ranges "explosive effects" are produced beyond the track of the bullet, which are especially marked when a bone has

been perforated, and consist of a funnel-shaped disorganization of the tissues beyond the point where the bullet makes its exit from the bone. This so-called "explosive effect" diminishes rapidly as the velocity and energy of the bullet decreases up to about 2,000 yards, beyond which point there is apt to be extensive fissuring and comminution of bone, instead of a simple perforation, as occurs at shorter ranges. I shall not stop to discuss the reasons for these different results at different ranges, but desire to ask your attention briefly to the surgical questions connected with the use of the new service bullet. It has been supposed that, from a humanitarian point of view, as well as from a military point of view, the new rifle is a great improvement over the old 45-caliber army rifle. But recent experiments indicate that this conclusion has, perhaps, been reached too hastily. Lieut. Stiles sums up his conclusions as follows: "It produces clean-cut, slightly lacerated wounds of soft parts, exerts less explosive action, and splinters and displaces bones less (except at short ranges); its wounds offer the best possible conditions for rapid and perfect healing, being small, clean-cut, and aseptic as a rule, but they are prone to bleed freely and at once." No doubt this is correct so far as the liability to hemorrhage and the prompt healing of simple flesh wounds is concerned, but the recent experiments of Demosthen with the Mannlicher rifle of 65 mm. caliber (about .26 in.) are not so favorable as regards bone injuries. According to Demosthen, whose report was presented to the Paris Academy of Medicine in 1894,* "The bone injuries produced by a small bore under the ordinary conditions of its use are more severe than those seen when reduced charges are had recourse to. Demosthen says that the shafts of long bones are fractured with much splintering and comminution, and this at long as well as short ranges, for he found but litttle difference in this matter between one humerus hit at 1,400 meters and another at 100 meters; that the statement of Bruns, Habart, Seydel, and others, that long bones may be expected to show clean-cut perforations without actual fracture at such distances as from 1,000 to 1,200 meters are not correct; that simple tunneling of even the epipyses of long bones is excep-

---

*Quoted from an article in *The Lancet*, by Brigadier-Surgeon-Lieut.-Col. W. F. Stevenson, Professor of Military Surgery, Army Medical School, Netley. *The Lancet*, London, March 9, 1895, p. 611.

tional, and that he has never seen it occur at ranges under 600 meters; that in sixty-five cases of fracture of bones (human) of all sorts, at ranges of from 5 meters to 1,400 meters, he has never seen simple perforation without fragmentation and splintering; and, finally, that the clean-cut character of wounds in vessels is in favor of severe hemorrhage even when only small arteries are injured. Demosthen does not hesitate to admit his difficulty in agreeing with those who are disposed to accord a humane character to the modern projectile.''

According to Lieut.-Col. Stevenson, Professor of Military Surgery in the Army Medical School at Netley, the earlier experiments on horses, made in England and France, gave an exaggerated idea of the severity of wounds made by the small-caliber bullets, inasmuch as the larger and stronger bones of the horse offer a greater resistance than corresponding bones of man, and "the extent and severity of a bullet injury are always in direct proportion to the resistance the missile meets with." Again, the experiments made in firing at human bodies at fixed ranges, with reduced charges, have led to mistaken inferences, as shown by the experiments of Demosthen, who fired at actual ranges with full service charges.

In considering the demands which will be made upon the Medical Department of the Army in the next war, and the necessity for a trained body of sanitary soldiers to remove the wounded from the field of battle to the dressing stations and field hospitals, we must also take into account the recent improvements in field artillery. The terrible, destructive power of the Frankfort arsenal shrapnel, which was issued to the light batteries of our army in 1893, is very vividly portrayed by Maj. H. S. Turrill, Surgeon U. S. A., in a paper read at the last meeting of this Association. Maj. Turrill says:

"The following is an example of the results of the shrapnel fire, at known distances: Target-silhouettes, to represent a platoon of light artillery (two guns), were placed to cover just the space, and in just the position that would have been occupied by guns, limbers, caissons, men, and horses of a platoon in action. At these targets were discharged ten shrapnel, the distance being 2,000 yards, and well known to the gunners. The result was that every gun, limber, caisson, horse, and man in the platoon (except two men) was hit, one target of a man having eight holes through it. The two targets not hit were the chief of platoon and a chief of section. At the distance of 2,000 yards

the velocity of the fragments would be but little less than 1,000 feet a second; with a six-gun battery of three and two-tenth inch breech-loading guns, those shrapnel could be hurled on that platoon of artillery in twenty seconds. It is not hard to calculate the amount of destruction that would have been caused by that storm of lead and iron sweeping through that platoon at the terrific rate of 1,000 feet a second, and the awful wounds that would have been made by those jagged pieces of steel driven by that tremendous force."

What has already been said is certainly sufficient to justify the existence of an Association of Military Surgeons of the United States, and those of you to whose intelligent foresight this organization is due, may well congratulate yourselves upon the success which has crowned your undertaking, upon the good already accomplished, and upon the promising future of this Association.

For the success of the present meeting, which is already assured, I have to thank the local Committee of Arrangements and the efficient Literary Committee, to whose efforts we are indebted for the excellent and varied list of papers which you will find upon the programme. [Applause.]

Vice-President Gihon was next introduced, and in a very eloquent and forcible speech recounted the glorious services rendered to this country by Dr. Benj. Rush, the first Surgeon-General of the United States Army. Dr. Gihon pictured his services as a signer of the Declaration of Independence, as a member of the Continental Congress, as a member of the Army, and his various good deeds, and his glorious death while trying to stamp out the pestilence of 1813. He spoke of him as a fearless, faithful, and unflinching patriot, a hero of heroes. The Association was raising a fund for the purpose of erecting a monument in Dr. Rush's honor, and Dr. Gihon had received $5,000 up to date, and wanted $10,000 more. He said Congress would undoubtedly donate the pedestal, and the movement would in no way antagonize the work of the American Association of Surgeons, who are trying to build a monument in honor of Dr. Gross. Dr.

Gihon said Dr. Rush was the greatest physician this country ever produced, and he urged all members of the Association to interest themselves in the monument fund.

A recess was taken at noon.

FIRST DAY—AFTERNOON SESSION.

President Sternberg called the Association to order at 2 P. M., in the Alumni Hall of the University of Buffalo.

The President announced the receipt of a communication from ex-Surgeon-General Burrell, resigning as a member of the Executive Committee, because of his unavoidable absence. The President appointed Gen. Forster (M. V. M) a member of the Executive Committee in place of Gen. Burrell. In place of the same gentleman, who also resigned from the Committee on Delinquents, the President appointed Maj. P. F. Harvey, U. S. A.

Assistant Surgeon-General Boeckman (N. G. Minn.) then read a paper, entitled "Asepsis in Military Service."

Gen. Nicholas Senn read the following-named paper: "Conservative Surgery on the Battle Field."

Dr. T. C. Clark (Stillwater, Minn.): I wish to report a case of gangrene supervening after elastic bandages had been applied for eighteen hours—a fracture of both bones of the middle third of the leg. The man was transported ten or fifteen miles by sled from the woods—this bandage was applied above the knee by some doctor—the man then transported 150 miles by rail. The leg was amputated at the upper third, but secondary amputation was necessary, gangrene supervening, and it was necessary to go above the point of constriction. Eighteen hours, I think, elapsed from the time the bandage was applied until the time he appeared in the hospital.

Dr. Roswell Park read a paper, entitled "The Location and Detection of Missiles."

Dr. Park demonstrated the use of the telephone probe in locating a charge of shot inserted into the haunch of a dog anesthetized for the occasion.

Col. Clayton Parkhill then read the following-named paper, by Capt. LeGarde: "Infected Bullets."

Dr. J. D. Griffith read the following-named paper: "Some of the Effects of the New Bullets, and How a Soldier can Protect Himself."

Vice-President Gihon in the chair.

Gen. M. O. Terry, N. Y., read the following-named paper: "The Value of Bromide in Military Surgery."

Col. Clayton Parkhill read the following-named paper, by Capt. A. LeGarde: "The Degree of Powder Burn," etc., etc.

A recess was taken at 5 P. M.

SECOND DAY — MORNING SESSION.

The meeting was called to order at 9.15 A. M., by President Sternberg.

Dr. J. D. Griffith, of Missouri, offered the following resolution, which was adopted:

WHEREAS, Membership in the Medical Corps of the Navy of the United States, from having been, through its high professional attainments, once eagerly sought by graduates of medical colleges, has ceased to be attractive to them, so that it is no longer possible to fill its vacancies; and

WHEREAS, It is believed that this is due to the inferior rank given to entrants to the corps, and their assignment, when at sea, to quarters in the steerage, with undergraduates of the Naval Academy and civilian paymaster's clerks, while the young medical

officer of the Army begins his career a grade higher, and in the commissioned officers' mess; and

Whereas, The professional requirements and qualifications, and the professional duties and obligations, of the medical officers of the Army and Navy are identical; therefore, be it

Resolved, That the attention of the Senate and House of Representatives of the United States be invited by the Association of Military Surgeons of the United States to this inequality, and that the Naval Committees of the two Houses be urged to inaugurate such legislation as shall confer upon the officers of the Medical Corps of the Navy the same status, pay, and emoluments as are now accorded to the Medical Officers of the Army.

Resolved, That this resolution be printed and copies of it, certified by the President and Secretary of the Association, shall be sent to the President of the United States, the Secretary of the Navy, and to every member of the LIVth Congress.

A recess was then taken for the purpose of inspecting several styles of litters placed upon exhibition.

Major E. T. Marsh, Surgeon 71st Regiment, N. G. N. Y., submitted three litters.

Major Wm. E. Spencer, Surgeon 23d Regiment, N. G. N. Y., submitted one litter.

Gen. Senn, of Chicago, submitted two litters.

Major DeNeidemann submitted one litter.

The Medical Department, U. S. A., submitted one litter.

The Committee on Litter presented its report, which, on motion, was adopted, and the Committee discharged.

On motion of Major Hoff, the Secretary was directed to send a letter of thanks to each of the gentlemen for their exhibits.

Vice-President Gihon stated that they had quite a collection of litters at Washington, and were purchasing litters and other surgical appliances for the field from the

various nations of Europe, and putting them where they could be readily inspected, and they would be very glad to receive models of the litters submitted here, or that might be devised by other medical officers in this country, and that would be a convenient place for the Committee to meet and study the whole question.

Dr. M. O. Terry: I would like to ask if the militia has any representation on the board which is to examine litters. I understood it was simply the Army and Navy.

President Sternberg: That was the understanding; and a committee was then to be appointed to report.

Dr. Terry: I would suggest that the militia be represented on the board.

President Sternberg said that this would be considered a recommendation for the future decision of the Surgeon-Generals of the Army and Navy, as to whether such a board should be appointed.

Major Alfred C. Girard, U. S. A., for the Committee on Constitution, presented draft of amendments to Constitution agreed to at the session of last evening.

A telegram was then read from Major Geo. Halley, Chairman Board of Censors, expressing regret at his absence, etc.

The subject of place of next meeting was then taken up.

Gen. Forster, on behalf of the Massachusetts delegation, extended an invitation to meet in Boston.

Vice-President Gihon: I have no authority to invite any one to go to Washington, but I wish to suggest to the Committee the wisdom of considering the advisability of establishing permanent headquarters for the Association in the City of Washington. I will guarantee

that they can have a place where they can meet, and it will not cost them anything.

Capt. Irwin, on behalf of the State of Ohio and City of Cleveland, extended an invitation to the Association to meet at Cleveland in 1896.

On motion, the amendments to Constitution, presented by Committee on Constitution, were referred back to Executive Committee, for the purpose of having a type-written copy prepared and presented to the Association. Carried.

Major J. Van R. Hoff, on behalf of the Senn Testimonial Committee, then secured the floor and invited to the desk Gen. Senn, who was received with a warm round of applause.

Major Hoff spoke as follows:

MR. PRESIDENT, GEN. SENN:

Realizing, as a citizen, physician and soldier, the obligation that our profession is under in peace times, to train men to take their places as medical officers when war comes, and appreciating the value of concerted action to that end, in September, 1891, you invited a number of medical officers of the National Guard to meet in Chicago with a view to organizing a medical military society in that branch of the National forces. The meeting was held, the name and constitution adopted; you were elected President, and the Association of Military Surgeons of the National Guard of the United States came into existence. At the second meeting, held in St. Louis, in April, 1892, in words so patriotic, so powerful, you outlined the mission of this Association. We read them each time with increasing wonder that you, upon whom such unceasing demands are made, could have found opportunity to gain so clear an insight into the requirements and relations of the military medical officer. The year rolled on, and a second time, as President, you directed the deliberations of the meeting in Chicago, in August, which re-organized the Society, opening wide its arms to admit all

the medical departments of the public services under a title broad and catholic, the Association of Military Surgeons of the United States. Again, only four years after you conceived the idea of this organization, you presided over a meeting of the Association of Military Surgeons of the United States, held at the capital of our country, in 1894, attended by nearly 300 members, representing all the medical branches of the public service, a meeting honored by the President of the United States, and others distinguished in our civil and military services. Then, having accomplished your object, having proved by the good work even already done by this Association, that the standing and usefulness of the military medical services can best be advanced by concerted action, having established the Association upon foundations broad and deep, you, against the entreaties of all its members, laid down the emblem of authority of its presiding officer, and took your place in the ranks with them.

As an evidence, General, of our appreciation of all that you have done for this Association and what it represents—military sanitation—and because we regard you as a friend and comrade, respect you as a man, honor you as a teacher, surgeon and soldier, your comrades of the Association of Military Surgeons of the United States offer you this testimonial. May the memory of happy meetings and enduring friendships cling about it. [Applause.]

The buckler, which was of solid silver, bore the following inscription on its outer rim:

"To Nicholas Senn, M. D., Ph. D., LL. D., Surgeon-General, N. G. Ills., the Association of Military Surgeons of the United States inscribes this testimonial, in grateful recognition of his services as its founder and first President, and in the advancement of military surgery; Fifth Annual Meeting, A. D. MDCCCXCV."

On the case in which the buckler was placed was a silver plate, bearing the inscription:

"Presented to Gen. Nicholas Senn, Surgeon-General Illinois, by the Association of Military Surgeons of the United States, Buffalo, May, 1895."

Gen. Senn replied as follows:

MR. PRESIDENT, MAJOR HOFF, GENTLEMEN OF THE ASSOCIATION:

To be made the recipient of so magnificent a testimonial for duties imperfectly performed, is an honor I know how to appreciate. In accepting the same, with a deep sense of gratitude, let me assure you that I appreciate the spirit that prompted it more than the intrinsic value of the gift.

The Association of Military Surgeons of the United States was born in Chicago, only four years ago. The babe has reached blooming adolescence, and promises robust manhood. In accepting this gift, let me, however, remind you that what has been accomplished in such a remarkably short time is due more to your efficient Secretary than to the one who conceived the idea of founding such an Association. [Applause.]

When I first met Col. Chancellor, responding to my humble call to establish an association of the military surgeons of the National Guard, he came there the very picture of manhood, blooming in health, a bald spot only the size of the palm of the hand disfigured his majestic head. Look at him now! [Laughter.] The few straggling hairs have turned gray, progressive emaciation, a gradual progressive tightening up of his belt, sunken eyes, wrinkled cheeks [laughter], are witness only too plain that he has been a martyr to the cause of this Association. If you have honored me with a gift in solid silver, let me assure you that he is entitled to one of pure gold, freely studded with diamonds. [Applause.]

We had the satisfaction, from the very beginning, to have the support, in realizing the objects for which this Association was founded, of the heads of the respective medical departments of the public service in the United States. We were too modest at the beginning even to hope for a union of the National Guard surgeons with those of the regular Army and Navy, and the Hospital Marine service, but what we could not hope for at the time was realized in the course of two years. We received the loyal support of the Surgeons-General of the Army and the Navy, and to-day our roster numbers among its members sixty-six officers of the regular Army and sixteen of the Navy, a handsome showing for those two departments.

I hope that the organization, so strong now, will become stronger from year to year. What has been accomplished I need not tell you. I point with pride to the volumes that we have issued, and which are recognized not only here, but the world over, as the best epitomes of modern military surgery. For assurance that the union between these various departments that I have alluded to is a solid one, and one that has come to stay, I need only point to the present occupant of the chair, the highest executive officer of the Medical Department of the regular Army, and to our esteemed representative of the Navy, Medical-Director Gihon, as one of your vice-presidents, and one of your future presidents. [Applause.]

This gift I highly appreciate, and it will be made a treasure in our family, and will be handed down to future generations as a memento of your gratitude to one who has labored humbly but faithfully for the welfare of the soldier in times of peace and war. [Prolonged applause.]

As an addendum to the foregoing, and for the benefit of the members of the Association who were unable to be present at the Fifth Annual Meeting to see the testimonial to Gen. Senn, and witness its presentation, the committee having the matter in charge have secured an illustration of the shield (see frontispiece), and have furnished the following brief account of the inception and carrying out of the project, as well as a description of the testimonial itself.

Recognizing that Gen. Senn was the father of the Association of Military Surgeons of the United States, has been three times elected president, and contributed largely by his personal efforts and generosity, as well as by his services as presiding officer, to its firm foundation and successful operation, it seemed to many members that his connection therewith upon his going out of office should be marked by some tangible and appropriate testimonial. The undersigned were solicited to take the matter in charge, it having been, from the nature of the case, impossible to secure any meeting of the scattered members of the Association for regular action. The

response to the notice sent out by the Committee was prompt and gratifying, a large proportion of the members of the Association contributing, subscriptions being chiefly based upon the rank of the subscribers. Gen. H. L. Burrell, Boston, Mass., and Major J. Van R. Hoff, Governor's Island, N. Y., acted as treasurers.

Designs were submitted by a number of prominent silversmiths in the country. That selected was manufactured by Messrs. Goodnow & Jenks, of Boston, from designs by D. P. Jenks of that firm, the work being done by W. B. Darby.

The testimonial is a Roman shield, eighteen inches in diameter, and convex. The main portion of the design comprises figures in high relief of a wounded Roman soldier, and "Mercy" hovering over him, and in the center is a Geneva cross of red enamel. Around the border is placed the inscription already given.

The shield was mounted on plush, and enclosed in shadow box for its protection and better display. The total cost of the testimonial was $415.00, being entirely paid by the subscriptions received.

It was intended that the presentation to Gen. Senn should be made during the first day's meeting, Tuesday, May 21, in the Star Theater, in Buffalo, but it was unavoidably delayed, and the event finally took place during the morning session of the second day.

The Committee feel satisfied, from the judgment of the members present, that their action in this matter has been confirmed by the members at large, and congratulate the Association upon the successful carrying out of this project.

The testimonial presented is believed to be not only an appropriate design, but one illustrating the high point to which American art has arrived.

COL. C. H. ALDEN,
Ass't Surgeon-General, U. S. A.
COL. LOUIS M. READ,
Surgeon-General, N. G. Pa.
MAJOR J. VAN R. HOFF,
Surgeon, U. S. Army.
SURGEON J. C. BOYD,
U. S. Navy.
LIEUT.-COL. E. CHANCELLOR,
Medical Director, N. G. Mo.
GEN. H. L. BURRELL,
Surgeon-General, M. V. M.

Capt. Myles Standish then read a paper, entitled "Color of Canvas," etc.

Major Clark: I wish to state that I think that is one of the most valuable and practical papers of the meeting. It is well known among gentlemen of the Army who are addicted to target practice that the men who are firing at the targets are obliged to turn their eyes away from the targets, and to look, either upon the ground, or upon something green to relieve the eyes; and a target is much less trying to the eyes than the roof of a tent. I never thought of it before, and I presume a great many others have not, but I can see very readily that the point made by Capt. Standish is one that should be taken into consideration. The only difficulty that I can see would be in the selection of a durable dye; but, as Americans have always overcome even greater difficulties than that, I presume this will also be met.

Vice-President Gihon: I think Major Clark's remarks are eminently proper, and that Capt. Standish deserves the thanks of the Association for having brought this matter before us. This is one of those papers that is peculiarly appropriate for the consideration of this Association, and the subject is one that has never been thought of before.

A recess was taken at 12 noon.

SECOND DAY—AFTERNOON SESSION.

President Sternberg called the meeting to order at 3 P. M.

The following-named paper was read by Major V. de Niedemann, who exhibited and explained the travois sub-

mitted by himself: "Notes on the Wounded on the Battle Field."

Major J. Wilkes O'Neill, Chairman of the Committee on Medical Journal, then presented its report, which will be found on page 69.

President Sternberg: I wish to say one word as to the action that the Surgeon-General of the Army is supposed to have taken. When the Committee called upon me, I think I did say that I would take 125 copies for the Army for one year, and then we would decide, from the character of the Journal, whether we should continue. The subscription was not to be for more than a year. I wish to say now, without reducing the number of copies, that the number of posts has been reduced, and the subscription could not be for more than ninety copies, and without any application beyond the first year's subscription, if it should be decided upon.

Gen. Forster moved that the question be indefinitely postponed. He said he objected to the publication of a journal for several reasons. One was that he wanted his proceedings to come in one volume, so that he could digest the whole thing and have it as a means of reference. He got now more weekly journals than he could possibly read, and sometimes they were not even opened. He believed this was also the case with many other gentlemen present.

Another objection was the expense. He (the speaker) had had some experience as part owner of one of the oldest medical journals in the country, and it was only within a year that they had got out of debt. Again, who was going to oversee the advertisements? For one, he (the speaker) did not want to see such advertisements as had been criticised in the proceedings of last year, and

such as had been recently criticised in the Journal of the American Medical Association. He emphatically disapproved of the plan of a medical journal.

Gen. Senn thought the labors of the Committee ought not to be ignored. They had labored not only one year, but had given mature consideration to the matter for a number of years, and quite a number of members were favorably inclined toward the project. They should also take as a guide the experience of other associations. He believed the American Medical Association began a few years ago to journalize their transactions, and that step had marked a great improvement, and had been of great benefit to every member of that Association. He thought the objections to having the issues oftener than once a year were not well founded, because he felt sure that every member in good standing would take the pains and go to the expense of having the volumes bound handsomely every year, ready for reference. Besides, the editor, whoever he might be, had already made an offer to furnish members with the transactions of the Association in a separate pamphlet at cost. He (the speaker) did not see what more could be asked. Considerable had been said and written about advertisements, so much so that he felt very keenly upon that subject. He believed that every medical journal in this country, and a great many in other countries, lived and thrived on legitimate advertising. It was one of the legitimate mediums through which the publisher, the manufacturer, the druggist, came in contact with the profession. The money that the Association could make in that way would be money legitimately earned. Why might we not take advantage of legitimate advertisements just as well as the greatest medical journal the world ever knew, the

British Medical Journal? That journal had more advertising than any journal in the United States. He (the speaker) hoped that the motion of Gen. Forster would not prevail.

President Sternberg: I notice there has been nothing said about the editing of this journal so far. The report of the committee contemplates something more than the papers read. It contemplates having a journal which shall have reviews and papers contributed from various sources; and that requires a competent editor, and I think editors generally are paid for their services. Has that been considered?

Gen. Forster: I should like to know what the Committee expect to pay that editor. We can not get him for love, to work year in and year out. We pay ours $4,000 a year. A certain amount of that goes to his subordinates.

Maj. O'Neill: While we can not get them for love, I think that a man will be willing to do the work for this journal, or assist in the editing of it, for a year, free almost of all compensation. However, that was a subsequent consideration. The question was whether we should publish a journal, and if that was decided in the affirmative, then the appointment of an editor and a committee to take charge of it would be considered afterward.

With the consent of his second, Gen. Forster withdrew his former motion, and moved that the matter lie on the table.

The question was then put on Gen. Forster's motion, and determined in the affirmative; ayes 23, nays 18.

On motion of Maj. Hoff the thanks of the Association were tendered to the Committee on Journal, and the committee discharged.

Vice-President Gihon in the chair.

Report of the Committee on Board of Censors presented by Maj. Girard, containing applications for membership.

Applications received and transferred to the appropriate committee.

The following-named paper was read by H. Lincoln Chase, First Lieut. and Asst. Surgeon, Mass. V. M.: "Measures for the Prevention and Suppression of Contagious Diseases in Garrison and in the Field."

A paper by Charles R. Greenleaf, Lieut.-Col. and Deputy Surg.-Gen., U. S. A., was read: "The Relation of the Red Cross Association," etc.

President Sternberg resumed the chair.

Gen. Forster presented the amended report of the Executive Committee upon the Revision of the Constitution, referred to that Committee.

On motion of Capt. Clark (Minn.), the report was accepted, and the report adopted as a whole.

Gen. Forster: A question came up before the Executive Committee, which is a very delicate one to handle, and the Committee were unanimous in saying that the matter should be brought before the Association. It is thought by the Committee, and by others outside of the Committee, that the words "Marine Hospital Service," should be stricken out, for the reason that it is not a military service. They only take charge of sick soldiers and sick sailors, and if they are to be taken in, it would be as well to take in police surgeons, railway surgeons, and any one who called himself a surgeon and wore a uniform. Therefore, the Committee respectfully suggest that those words be stricken out wherever they occur. It is an awkward thing to do, as we have some members

from that service now, but they would be placed on the associate list of the Association. To hasten matters, I would move that those words be stricken out wherever they occur, and that the present members, who have entered under that head, be transferred to the associate list.

Motion seconded.

Upon the suggestion of Capt. Clark (Minn.) and Capt. H. E. Mann, Gen. Forster, with the consent of the Association, changed his former motion to read as follows:

"That the words, 'and Marine Hospital Service,' be stricken from the Constitution, as they refer to active members; such action, however, not to alter, in any wise, the status of any present member of the Association."

Carried.

Gen. Forster then read a proposed clause of Constitution, reported by Committee on "The Duties of Officers," and the clauses relating, respectively, to President, Vice-President, Secretary, Treasurer, Editor, Executive Committee. Adopted seriatum.

Vice-President Gen. Gihon moved that all papers presented to the Association, and read before it, shall become the property of the Association, and shall not be printed except by permission therefrom.

Motion seconded.

The question was then put on the adoption of the clause reported by Executive Committee on Military Committee, and determined in the affirmative.

Clause relating to Publication Committee was then adopted as amended, by the motion of Gen. Gihon.

Moved by Major Clarke, that the proceedings of the Association be copyrighted.

Surgeon-General Priestly also advocated the copyrighting of the proceedings.

Major Harvey objected to such a course, saying that the publications were essentially philanthropic in character, and it was in the interest of humanity to give them the widest dissemination possible.

On motion of Major Carr, the question was referred to the Executive Committee, with power, and it was subsequently decided by that Committee that an author desiring to publish his paper prior to its appearance in the Transactions might do so by obtaining the permission of the Executive Committee.

Moved by Gen. Bryant, that the amended Constitution and By-Laws be properly transcribed, and presented at the next meeting.

Carried.

Vice-President Gihon in the chair.

The Executive Committee retired, and the interval was devoted by the Association to an informal discussion of the possibilities of the bicycle litter.

President Sternberg resumed the chair.

The Secretary reported the following names, as recommended by the Executive Committee, for honorary membership:

Austin Flint, M. D., New York.
Gen. Robert Murray, retired, U. S. A.
Charles Page, retired, U. S. A.
Gen. John Moore, retired, U. S. A.
Col. Joseph R. Smith, retired, U. S. A.

The question put on the adoption of the report, and unanimously determined in the affirmative.

The Treasurer submitted the following names, recommended for associate membership:

Col. Edmund C. Brush, Ohio, Officer of the Line,
John H. Brough, Pennsylvania.

Roswell Park, New York.
Thomas W. Floorer, Texas.

And for active membership:

Lieut.-Col. Robert Allen Blood, Charleston, Mass.

At 5 P. M. a recess was taken.

THIRD DAY—MORNING SESSION.

Thursday, May 23, 1895.

The meeting was called to order by President Sternberg, at 9 A. M.

The following paper was read by Major Philip F. Harvey, U. S. A.: "The Post Exchange from a Medical Standpoint."

Vice-President Gihon said that the paper was one of the most valuable presented, and he was very glad that Major Harvey had diverted the minds of those present from the "bloody" part of the doctor's work, and had invited attention to the "Post Exchange" and its benefits. He (Dr. Gihon) had been interested in that work in the Navy for a great many years, and recently had had occasion to visit Fort Sheridan, where he saw the magnificent results of the "Post Exchange." The Post Exchange was located in a large, clean building, with well ventilated smoking and reading rooms, a place where none need hesitate to visit, and a room where the officers could go and drink the same beer the men were drinking, and smoke the same cigars. In the Navy, at the Marine Barracks, there was still the old-fashioned "canteen," run by some old, retired sergeant, where most everything sold was of poor quality. At Mare Island the stuff sold mostly was a mixture of alcohol and common California

port, of a quality that none would care to drink but a very small quantity. That "canteen" happens to be in charge of a lady, the widow of a retired officer, who, of course, does not attend the bar at the "canteen" herself, but hires a substitute, and it is conducted at a profit of many thousand dollars a year, an amount which might better be expended among the men for the improvement of their rations. He looked upon the encouragement of beer drinking favorably. Some years ago, when he was at Annapolis, there was a practical illustration of the value of beer drinking given the students there. As a rule, conventions that come to Baltimore are taken to Annapolis, and it so happened that one day the National Temperance Society came there on a big steamer, about a thousand of them, and the cadets had an opportunity of witnessing a large number of very excellent men, perhaps rather pallid in complexion, rather small in size, and somewhat listless in manner. Altogether, very good men, no doubt, but rather quiet men. And it so happened that, by a special provision of Providence, the next day the National Brewers' Association came down, about a thousand of them; they were jolly, red-faced, and, as a rule, heavy-set, full of fun, laughing, and having a good time generally. Naturally, the cadets had the lesson before them, which of the two class of men would they rather be?

As regards the lunch counter, he considered that an exceedingly valuable thing, particularly in the service where the men breakfasted at eight, dined at twelve, and supped at four, and from four to eight get nothing at all, and taking into account the evening meal is a pretty small affair—usually, hard tack and tea. Now, to give the men an opportunity to go and buy something to eat

is a very valuable and excellent thing. They have the evening to themselves up to eight o'clock, and can go in and buy sandwiches, pies, or anything they wish, to break the long wait between the evening meal and breakfast. He wished to bear testimony to the admirable work being accomplished by the Post Exchanges, and would help in every possible way to sustain them, and sustain the medical officers in maintaining them and opposing the pressure, which is very strong, to do away with them in the interest of certain individuals. It is much better, he thought, that the profits be used for the benefit of the men rather than for the enriching of half a dozen individuals.

A paper by Dr. F. W. Byers, entitled "A Medical Officer in the Volunteer Army," was read by title.

Dr. F. W. Byers, in explaining the character of the paper, stated that it was made up largely of statistics and incidents of a personal nature, and he would not take up time by reading it; that he felt toward his paper about as the old brother in the ministry who had a boy that he thought was the best-looking, smartest, and best boy in the world. The boy was taken very ill, and after being very much exercised over his condition, and watching him for a long time during his delirium, the boy finally fell asleep; and the old fellow looked at him, and thought of all he had gone through, and thought if the boy could sleep he was going to get well, and he said to himself: "I am so glad; I would not want to live without you, and I would not take $100,000 for you, but I wouldn't give a nickel for another like you."

Col. Dallas Bache then read a paper, entitled "Field Hospital Service."

Vice-President Gihon remarked that as Col. Bache had quoted so largely from British authorities, the Association would, no doubt, like to hear from Gen. Ryerson, of Her Majesty's service.

Gen. Ryerson, in response to a very hearty greeting, said that he felt very much honored a year or two ago when he was elected a member of the Association; that he had been, for many years, a volunteer soldier in the Canadian militia, and his heart had always been in the work. No matter what the color of the uniform, or the color of the flag, he says, "my heart always goes out to soldiers." A year after the founding of this Association he endeavored to organize a society on somewhat similar lines in the Canadian militia. That society had a first meeting, but, for various reasons, no meetings have been held since. One of the reasons being, while it is not openly discouraged officially, there are certain things which act in a prejudicial manner, so far as the society is concerned; but, inasmuch as the chief power creating these objections has recently been removed, he had hopes of having another meeting, and, should the meeting be held, he wished his friends at this Convention would be present. The extracts, which my friend has read as to how the medical service in the British Army has been treated, is correct. But the struggle which has been going on for many years, and which was begun in London by Sir John McGregor, is continued to-day, and little by little the service had gained in position and strength. However, there is much yet to be accomplished. But this much has been conceded, that "Surgeons are soldiers." In the Canadian militia the medical service is in a very crude state. It is true there are a certain number of men detailed for each battalion trained for ambu-

lance work, but that they had no hospital corps. He stated that efforts had been made to have corps established in Montreal and Toronto, to be composed of the medical students. He hoped to see a corps fully established before next year. That the same prejudice existed in Canada as in England, though not in so marked a degree, against the "bloomin' doctors." He hoped the medical service in Canada would soon be placed in a position to receive its just rights.

Gen. Ryerson regretted that he had not attended the meetings sooner, as he had listened with great pleasure to the papers read, and the information derived he knew would be of great value to himself and the Canadian militia.

Capt. Myles Standish said he could not help getting on his feet when this subject was under discussion, because he was an example of a "medical tactical officer." Massachusetts has a company, of which he is Captain; his duties do not lie in the hospital at all, but in the management and transportation of the wounded, and in the control of the company. That he is permanently detailed to command the company, and has all the duties and responsibilities of a commanding officer, and is responsible only to the Surgeon-General. That he had been asked what his duties are, and that he replied he had a full company, the same as an infantry company. Capt. Standish went on to say that he thought good, competent officers could be got among medical men to take command of such companies, although there seemed to be an opinion generally to the contrary. That in Massachusetts their experience had been that medical men made good tactical officers as well. That such men could be found to train the men in taking care of the

wounded, and in transporting them to the hospital from the time they fall.

Gen. Byers here related the story, as told to him, showing how medical men were thought of by soldiers; that his friend, being uniformed in the surgeon's uniform, was surprised to have a new recuit walk right by him and never look at him. He thought it necessary to jack up the fellow a little, and instruct him in what he should do. He turned around and said, "Don't you know it is your duty to salute an officer?" The recruit said, "Yes." "Then," he said, "Why don't you do it?" The recruit remarked, with a foreign accent: "Oxcuse me, if you please; I was instructed to salute an officer, but I thought you was a doctor."

Major Harvey, of the Committee on Delinquents, reported as follows:

Your Committee on Delinquents beg respectfully to report that they find due from members who have failed to answer communications over $300; that, with the dues for this year, the amount will be increased to a sum over $500; that there is due from various other sources from delinquents, of all other descriptions, sums which will amount nearly to $600. Your Committee have, after due consideration, thought it best that the Secretary communicate with each gentleman indebted to the Association, putting the payment of his dues entirely upon his honor as an officer and a gentleman, and that failing to collect the dues by such efforts, the names be dropped from the roll of the Association.

On motion of Col. Forster, the report was adopted.

On motion, it was resolved that the names of contributing members be added and included in the report.

The following-named paper was read by its author, Col. Dallas Bache: "The situation of sites for, and the construction of Military Posts in relation to proper sanitation."

The Nominating Committee presented the following report.

Your Nominating Committee beg leave to submit the following report:

For President for the ensuing year, Col. Read, of Pennsylvania.

For First Vice-President, Medical-Director Gihon, of the U. S. Navy.

For Second Vice-President, Assistant Surgeon-General Charles H. Alden, U. S. Army.

For Secretary, Col. E. Chancellor, St. Louis.

For Treasurer, Major Carr, of Ohio.

Place of meeting for 1896, the city of Philadelphia.

The matter of Editor of the Proceedings was referred by your Committee to the Executive Committee.

Most respectfully submitted,

J. D. GRIFFITH, *Secretary.*

J. C. BOYD, *Chairman.*

The report was unanimously adopted.

The following resolution was then offered by Col. Clark:

Resolved, That the Secretary be allowed the sum of thirty ($30) dollars per month for the services of a competent stenographer and amanuensis for the ensuing year, or such further sum as, in the opinion of the Executive Committee, may be necessary.

Adopted.

On motion of Capt. Myles Standish, Major Philip F. Harvey, U. S. A., was duly elected Editor of the Proceedings.

Gen. J. D. Griffith offered the following:

Resolved, That the thanks of the Association are emphatically due, and are hereby most gratefully tendered, to His Honor, Mayor Jewett; Hon. Sherman S. Rogers, and other distinguished citizens of Buffalo, for honors and attentions received at their hands; to the

citizens of Buffalo generally for the warm welcome and courteous greetings extended to the members of this Association; to Gen. S. M. Welch, Jr., Col. George C. Fox, and the officers of the 65th and 74th Regiments, N. G. N. Y., for their fraternal and soldierly demonstrations in recognition of the military importance of the Association; to the members of the medical profession of Buffalo for great assistance and encouragement given the Association during the session, particularly to the faculty of the University of Buffalo, for the generous act of placing that institution, with its many conveniences, at the disposal of the Association for its meetings; to Mayor A. H. Briggs, and his associates on the committees, for the reception and entertainment of the Association, for the complete arrangements so carefully made and so admirably carried out for the business of the meeting and the enjoyment of the members; to Mr. R. C. Hill, the most efficient Secretary of the Buffalo Committee, for valuable aid given to officers and members of the Association, particularly to the Secretary, and especially for the handsome and most interesting souvenir book programme which he has prepared and published for the occasion; to Messrs. Woolley & Gerrans, of the Hotel Iroquois, for meeting accommodations and other facilities furnished the Association during its deliberations; to Manager Major, of the Star Theater, for the gratuitous use of his splendid house for the opening exercises of the Association; to the press of Buffalo for the admirable and exhaustive reports published of the proceedings of the Association, and especially to the *Express*, for its illustrated and other excellent articles concerning the history and work of the Association; to the officers of various public institutions which the Association has been most courteously invited to visit; to the members of the Buffalo Club, for their unstinted hospitality, and to other clubs and societies which have extended invitations and courtesies, and to all individuals who have assisted the Association, and its members, during their stay in the truly beautiful and progressive City of Buffalo.

Adopted unanimously.

Vice-President Gihon presented the following:

RESOLVED, That, with as little delay as possible, the Secretary shall send to the Chairman of each committee a list of his associates,

and request that he communicate with them at once, with a view of obtaining their concerted action; and in the event of his inability to act, that he advise the next member on the list, who shall act as such Chairman.

RESOLVED, That, not later than one month before the annual meeting, the Secretary shall communicate with the Chairman, or Acting Chairman, of each committee, informing him of the necessity of placing the report of said committee in his hands at least one week before the annual meeting.

Adopted unanimously.

Vice-President Gihon, in behalf of President-elect Read, announced the following as the Executive Committee for the years 1895 and 1896:

Col. Nicholas Senn, Chicago; Col. Chas. H. Alden, Washington; Joseph D. Bryant, New York; Col. C. M. Woodward, Tecumseh, Mich.; Gen. Budlong, Rhode Island, and Maj. Briggs, of Buffalo.

Maj. Wiley read a paper entitled "The Field and Hospital Service of the National Guard of Pennsylvania, and the 28th National Encampment of the G. A. R. at Pittsburg."

Maj. Girard then read a paper, entitled "Dust, a Source of Typhoid Infection in the Military Service."

Lieut. Halberstadt related an incident of "walking typhoid" at the encampment at Gettysburg last year, where a man asked to be relieved from duty, but his request was refused, and he was sent to the kitchen. It afterward transpired the man was sick, and on investigation it was found he had "walking typhoid," and out of fifty-six men in his company twenty-two were taken sick, and there were three deaths, but there was not another attack in the brigade.

On the question being asked if there was any proof that the man first mentioned was the cause of the twenty-

two cases, Lieut. Halberstadt said that there was not, but, on investigation, it was found he had handled the food that the men in that company had.

The President: I would take the liberty of suggesting that a possible source of the infection was the excreta which had been thrown around and been carried by the flies.

Lieut. Halberstadt said that the trouble with that theory was, there were 2,300 men in camp close together, and that was the only company affected, and if the flies had gone to that particular company it would be all right, but they might have gone to any other company in the brigade.

Maj. Hoff stated that perhaps that was the only company in that brigade that had any flies on it.

A recess was taken at twelve noon.

THIRD DAY — AFTERNOON SESSION.

President Sternberg called the meeting to order at 2 P. M.

The following-named paper was read by Orlando J. Brown, Lieutenant and Assistant Surgeon M. V. M.: "Effects and Treatment of Heat and Sunstroke," etc.

Capt. D. M. Appel, U. S. A., explained the use of the Rice combined military garment and belt.

Gen. Forster called attention to the system of veterinary supervision introduced in the Massachusetts V. M., and to the good work accomplished.

Messrs. Chase and Kauffman endorsed the policy of Massachusetts. The latter also made a strong plea for

a modification of the helmet; that in use in New York was too large, caused headache and complaint on part of the men, and they were often disabled. What was wanted was more air and more shade on the sides.

Lieut. Halberstadt thought some one ought to tell us how to cook, what to carry in case of emergency, hints as to foods and their preparation, and all that sort of thing.

Maj. Hoff stated that just now orders had been issued in various geographical departments, convening boards, with a view to investigating this subject, and recommending the best practicable marching ration.

Vice-President Gihon explained that, owing to a misdirection, the litter forwarded by Major Matthews of the Army had miscarried, and assured the Association that they would be well repaid by making an inspection of it. It was understood that this litter would be placed on exhibition at the Broadway Arsenal, where it could be seen in the evening.

Gen. J. D. Griffith offered the following resolution:

Resolved, That we extend our heartfelt thanks to Surgeon-Gen. George M. Sternberg for his prompt and faithful attendance, his impartial rulings, and his unfailing courtesy as presiding officer during the deliberations of this Association at its fifth annual meeting.

Carried unanimously.

President Sternberg: Mr. Vice-President and Gentlemen, I appreciate your very kind resolution, and I on my part wish to return thanks to the members for their kind assistance and their uniform good nature, and to congratulate you all upon the success of this meeting.

President Sternberg resumed the chair.

President Sternberg: We still have time for a five-minute speech from Gen. Senn.

MR. PRESIDENT AND GENTLEMEN:

I came here this afternoon for a special purpose, and hoped to have the opportunity of seconding a motion returning our sincere thanks to our retiring President, for the able and impartial manner in which he has conducted the deliberations of this Association, but it seems that I am too late. I feel that the time has come, Mr. President, when we can be assured of the future success of this Association — that sectional feeling has been entirely eliminated; and I think we could have no stronger evidence of the future prosperity of the Association than the fact that the Chief Executive of the Medical Department of the Regular Army, who has shown so much interest in the Association during the last year, will be with us in the future. Let me express the hope that he will give to it the moral influence of his presence at every future meeting. [Applause.]

Major Briggs, of the Local Committee, then announced the programme for the afternoon, evening, and next day for the entertainment of the Association, and, on motion of Major Hoff, the session of the Association was declared adjourned *sine die*.

Reports

of

Officers and Committees.

SECRETARY'S REPORT.

May 1, 1895.

MR. PRESIDENT:

In obedience to the requirements of our Constitution, I have the honor to submit the Fourth Annual Report of our Proceedings, which is a full synopsis of official duties devolved upon me, and the status of the Association connected with my department since its last annual meeting, held at Washington, D. C., May 1–3, 1894.

It is with pride and pleasure we may note the exceptionally prosperous condition of our organization, which has proven superior to adverse financial and business conditions, unfortunately so generally prevalent throughout our country during the past year.

1. The statement of the praiseworthy objects of our order in the literature which was widely distributed to all those known to be eligible to membership, doubtless largely contributed to the increase of our roster in the past twelve months, and due credit must also be given to our active and interested members in the United States Army, Navy, and National Guard of the various States, for valuable accessions, directly attributable to their efforts and courtesies.

On May 1, 1895, the roster contained 348 active members, 44 honorary members, and 31 contributing members.

The active members are classified as follows:

United States Army,	62
United States Navy,	18
United States Marine Hospital Service,	12
National Guard of the United States,	256

The new members received, since the last annual meeting, number 169. The Association has lost but sixteen active members since the last annual meeting, but it will be observed that these vacancies were promptly filled by new members.

CORRESPONDENCE.

1. The great and miscellaneous mass of correspondence rendered necessary by the demands of our organization, can hardly be com-

prehended by those not familiar with the duties and requirements devolving upon your Secretary, demanding his daily, hourly, and almost constant attention. Some idea of the extent of the pains-taking labor required, and time necessarily consumed, may be obtained, however, when it is considered that the correspondence of the Association, comprising letters received and responded to, has, during the past year, averaged twenty-four letters per day. Several thousand letters have to be written annually in the interest of "farming out" the advertising space in our published Transactions, and all the further correspondence thereby rendered necessary.

2. The necessary correspondence with applicants for membership; with members of the Association; the preparation and distribution of reports and literature — more than 2,500 letters having been necessarily written from this office upon the subject of our Proceedings alone during the past year; the procuring and distribution of our badges and buttons; the semi-annual revision of our roster; correspondence with exchanges; issuing all certificates of membership; keeping monthly accounts with our Treasurer; courteous responses to innumerable inquiries as to our Association, its status, objects, eligibility, etc., etc., by both members and non-members—inquiries, in many instances wise, and in many instances otherwise—but all requiring courteous official treatment, and no small portion thereof coming from foreign countries, and written in foreign languages; retaining copies of all responses to correspondence — these comprise the almost daily routine of some of the duties connected with this office.

3. Too large a percentage of such correspondence plainly evidences such dense ignorance of non-member inquirers as to require considerable patience to even officially deal courteously therewith. For instance, letters were received inquiring where a dead soldier relative was killed and buried during the late Civil War, and demanding also the name of his Colonel and Captain. Another sample inquiry of the class indicated came from New Orleans, demanding the date of death and the name of the surgeon who attended a mortally-wounded relative on some battle field in the War of 1812. And it has not infrequently happened that persons professedly eligible to membership have presumed upon such profession (but seldom, or

never demonstrated eligibility) to solicit and utilize the, no doubt, highly-appreciated services of your Secretary, rendered in behalf of such persons, in selecting and forwarding not only various surgical instruments and appliances, and medical literature, but also samples of dress goods, shoes, and other articles of wearing apparel — so popular is our Order, and such a bureau of information, military encyclopedia, and great utility man must its Secretary be presumed to be. Add to these "duties" that of Commissary-General of Subsistence, Quartermaster, Paymaster, and general superintendent of all things not the special duty of any one else to attend to, and the fact that his office is the only recognized business headquarters of the Order, and some idea may be gained of the manifold and continuous duties of the Secretary.

4. I thus call attention to the multifarious and exacting duties devolving upon the Secretary of our Association, not in the spirit of complaint or murmur on account of such services cheerfully rendered in the past, but in the hope that my successor, in view of the responsibility connected with this office, may be properly encouraged and rewarded; for, possibly, he may be either too modest to speak for himself, or possess over-confidence in his ability concerning an untried experiment.

5. In this connection, permit me to suggest that, in my humble judgment, based on four years of experience, the duties and responsibilities now expected and required of your Secretary, and ever increasing with our increasing membership, are too arduous for any one person to be reasonably expected to satisfactorily perform with the assistance now provided, even if he should give his entire time and attention thereto. I therefore respectfully recommend either that provision be made for ample assistance to enable him to readily and properly transact the business now required of him, or that a considerable portion of his labors and responsibilities be appropriately transferred to, and distributed among, the other officers of this Association.

6. One of the most perplexing and difficult branches of correspondence has been keeping pace with the changes made in the regular service, as well as in the National Guard, in promotions, resignations, transfers, retirements, and other mutations.

7. During the year it seemed necessary and prudent, if not imperative and essential to the good of the organization, to issue

from this office three official circulars, by and with the consent and approval of the President, containing what was deemed absolutely necessary information to the members of our Order, and others interested in our welfare. These circulars speak for themselves.

CERTIFICATES.

1. Since the action of the Executive Committee, in 1894, making it compulsory for members to purchase diplomas at fifty cents each, I have received but sixty-two applications therefore, which fact may serve to suggest some appropriate action with reference to the subject matter.

2. The Secretary has in his possession thirty-one diplomas, which were duly ordered and made out in legal form for honorary and contributing members, but which have not yet been called for or delivered.

3. The form of certificate for life-membership has not yet received the sanction of the Executive Committee, though that subject is at present receiving the attention of the said Committee.

4. It may be noted that all diplomas are stamped or dated from the last meeting place. This seems necessary, in the absence of a permanent headquarters, the last meeting place being tacitly regarded by the members as the Association headquarters until the next succeeding meeting.

EXCHANGES.

1. Officially, the Secretary has been the grateful recipient during the past year of many courtesies from authors, editors and publishers, but none have contributed more profitable literature than that received from the offices of the Adjutant-General and Surgeon-General of the United States Army, the Bureau of Medicine and Surgery of the United States Navy, and the Supervising Surgeon-General of the Marine Hospital Service, all of which have greatly facilitated a more thorough routine of, and contributed largely to, the valuable information contained in this office.

2. A recent act of Congress (January 12, 1895,) has denied the gratuitous distribution of any publications from the Military Service in Washington. Such document can now only be purchased from

the Public Printer, which fact has of late seriously affected the work of your Secretary.

I have been honored likewise, officially, through the kindness of the Adjutant-Generals of the several States, by being placed on their general and special mailing lists, and receiving valuable official documents from time to time, for which this Association should extend its grateful acknowledgement.

3. On the other hand, hundreds of letters and worthless or questionable periodicals have been received, doubtless transmitted in the hope that a volume of our Proceedings would be sent in exchange.

This demand of outsiders for copies of the report of our Proceedings has been an ever-increasing one since our organization, and perhaps more care and attention should be given to the repository of power to always secure the exercise of due discretion in the important matter of our exchanges.

ANNUAL PROCEEDINGS.

1. The proceedings of our last meeting at Washington were, through some inadvertence and misplaced confidence, officially reported by an irresponsible and hilarious stenographer, who celebrated his efforts by losing the notes of his report in the Capitol building, in which he was permanently employed; but, through the courtesy, generosity, and superior detective ability, coupled with the untiring energy of Major George Henderson, the lost notes were partially recovered and transcribed, and important omissions supplied from the daily press reports and the ready assistance of our members.

Under the circumstances the wonder is, not that there were defects, omissions, and imperfections in our last report, but that we were able to prepare a presentable report at all.

Too much credit can not be given Major Henderson for his energy, tact, perseverance, and success in this particular direction. Results would not have been so favorable, however, without the more than mere business pride and interest exhibited by Mr. Wolff, agent of the publishers, to whose skill, pains, and taste is attributable much that renders the volume artistic and attractive.

2. In spite of the misfortune of adverse circumstances, however, the fourth annual volume will doubtless be recognized as superior

in general make-up to any former edition, having a complete and valuable index, beautiful illustrations, photo-engravings, etc., and being handsomely bound.

3. Eight hundred copies of this volume were received from the publishers on October 27, 1894. Owing, principally, to the quality of its contents, this volume did not require for its introduction to the expectant public the flattering editorial comments which greeted its advent, appearing in the various medical journals and secular press of the country.

4. On July 22, 1894, 500 copies of Volume I were also received by me, and 136 copies distributed in accordance with instructions from the Executive Committee.

5. In the past, a limited number of volumes have been furnished to members on application, but a continuation of such custom was deemed impracticable by the President, hence only one copy of the fourth annual volume could be delivered by the Secretary to each member and contributor. Of course, this rule necessarily governs the Secretary until otherwise directed by competent authority, however much he, as well as some of the members affected by it, may regret its existence.

The number of copies now remaining on hand are as follows:

Volume I	357
Volume II	149
Volume III	87
Volume IV	299

The number of copies sold during the year 1894-95 are as follows:

Volume I	7
Volume II	5
Volume III	12
Volume IV	6

DISTRIBUTION.

1. The distribution of nearly 500 copies of the fourth annual volume, through the agency of the express companies and the United States mail, was a pleasing diversion from the worriment and anxiety attendant upon its compilation.

2. Pursuant to the directions of the Association, one copy of Volume IV was sent to each active and honorary member, one copy to each of the editors of 53 selected medical journals, and 36 advertisers, while the daily press, and several libraries and public institutions, were not forgotten, amounting in all to 495.

ADVERTISEMENTS.

1. The solicitation of, and obtaining, a few first-class and legitimate advertisements from proprietary medicine concerns and surgical instrument houses, for insertion in this volume, to meet in part the cost of publication of the fourth annual volume—though vigorously opposed by some of our members—was deemed an absolute necessity by the Executive Committee, whose decision was ratified by the Association, and the wisdom or impropriety of such action thus placed beyond cavil or question. Extreme care was taken, however, that the discretionary power thus conferred upon your Secretary should be exercised wisely, and in such a manner as to reflect no discredit upon our Order, and in the hope that the end attained will be recognized as justifying the means adopted for its accomplishment.

While many advertisements were accepted, many were rejected. The result of the experiment is respectfully submitted, and speaks for itself.

FINANCES.

1. It would seem perfectly safe to state that the experimental stage is passed, and the financial condition is most flattering for the future welfare of the Association.

During the year the receipts by me, which were turned over to the Treasurer, have been as follows:

From active members, ...	$480 00
From sale of Transactions, ...	52 63
From sale of diplomas, ...	31 00
From sale of official ribbon, ...	6 75
From advertisements, ...	970 50
From "die" presentation (Col. Woodward), ...	5 00

2. The total expenses of this office during the year have been $578.59, which includes all expenses for the services above indicated.

The most stringent rules have been enforced by this office, in view of the times during the past year, for curtailing expenses, and for the practice of the most rigid economy practicable.

3. The demands for our official literature, both at home and abroad, during the past year, have been both urgent and unprecedented, and the flattering increase in our membership may be, in a considerable measure, attributable to its liberal distribution.

PERSONAL.

1. I should feel that this report would be incomplete without containing my grateful acknowledgment for the valuable assistance of Capt. James E. Pilcher, U. S. A., rendered to your Secretary in time of need, when illness had incapacitated him for attending to the various duties of the Secretary — to the accurate revision of proofs for the fourth annual volume, and the skillful and scholarly construction of its excellent Index—the thanks of the Association are due, largely, to the cheerfully tendered and gratefully accepted services of Capt. Pilcher.

2. I am likewise placed under many obligations, both officially and personally, to the heads of the Departments at Washington, D. C., for many courtesies, and also for valuable literature received from time to time, which is now in the leased-quarters of the Secretary as the property of the Association, and will be of incalculable benefit to my successor and the members of this Association.

3. Lastly, but most highly appreciated, I feel impelled to add my sincere gratitude for the uniform kindness and courtesies which have characterized my official and personal relations with the officers and members of this Association, whose continued esteem and confidence, as a member of this grand Association, it shall be my highest ambition to merit.

Very respectfully submitted,

E. CHANCELLOR, *Secretary.*

ST. LOUIS, MO., May 1, 1895.

SUPPLEMENTAL REPORT.

The complete inventory of all property of the Association, on hand May 1, 1895, and not contained in the classification of 1894 (Pages 52, 53, Vol. IV.), is as follows:

One Rubber Stamp — "Washington, D. C."
One Rubber Stamp — "Association of Military Surgeons of the U. S."
One Rubber Stamp — "Paid. Printed Matter Rates."
One Rubber Stamp — "General George M. Sternberg, U. S. A., President."
One Rubber Stamp — "Asst.-Secretary, Julian M. Cabell."
One Rubber Stamp — "Major Lawrence C. Carr, Treasurer."
One Rubber Stamp — "All Bills Payable to Major Lawrence C. Carr, Treas."
One Rubber Stamp — "For Deposit, pay to the order of Major Carr, Treas."
One Rubber Stamp — "Capt. James E. Pilcher, U. S. A."
One Rubber Stamp — "Major Albert H. Briggs, Chairman."
One Rubber Stamp — "For Review."
One Rubber Stamp — "Return to the Secretary."
File No. 1 — Names of Drug Co's., etc., from whom advs. were solicited.
File No. 2 — Correspondence of Gen. George M. Sternberg, U. S. A., Pres.
File No. 3 — Publishers' and Stationers' Bids, 1894.
File No. 4 — Active Members, 1894–95.
File No. 5 — Honorary Members, 1894–95.
File No. 6 — Contributing Members, 1894–95.
File No. 7 — (A) General Correspondence, 1894–95.
File No. 7 — (B) General Correspondence, 1894–95.
File No. 8 — Blanks for Advertising Contracts.
File No. 9 — Official Circulars, No. 1.
File No. 10 — Proofs of Advertisements.
File No. 11 — Replies from Committeemen, 1894–95.
File No. 12 — Correspondence with Special Advertisers.
File No. 13 — Contracts with Advertisers.
File No. 14 — Circular Letters, Notification of Membership in the Ass'n.
File No. 15 — Correspondence with Delinquent Members.
File No. 16 — Complete Revised List of Medical Officers in N. G. of U. S.
File No. 17 — Correspondence with Med.-Director Albert L. Gihon, U. S. N.
File No. 18 — Correspondence about Publication of Vol. IV.
File No. 19 — List of Standing and Special Committees.
File No. 20 — Suggestions for Circular No. 2.
File No. 21 — Report of Committee on International Congress.
File No. 22 — Correspondence with Express Companies about overcharges.
File No. 23 — Correspondence about Electros of President Senn's.
File No. 24 — Correspondence with Major A. C. Girard (Ch. Com. on Laws).
File No. 25 — Correspondence with Badge and Seal Committee.
File No. 26 — Correspondence with Literary Committee.
File No. 27 — Correspondence with Committee of Arrangements.
File No. 28 — Resolutions to be presented at the Buffalo Meeting.
File No. 29 — Correspondence to be taken to Buffalo.
File No. 30 — Clippings, Comments, and Criticism on Vol. IV.
File No. 31 — Errors and Corrections, 1894.
File No. 32 — Correspondence about the Washington Meeting, 1894.
File No. 33 — Miscellaneous Business, 1894.

One Letter-Press Book, copies of Letters written from May to Sept., 1894.
File No. 34 — Copies of Letters written from Sept. 10 to Nov. 13, 1894.
File No. 35 — Copies of Letters written from Nov. 13 to March 29, 1895.
File No. 36 — Copies of Letters written from March 29 to May 18, 1895.
One Wire File — Special Correspondence, 1894–95.
One Wire File — General Correspondence, 1894–95.
One Wire File — Members who have received Diplomas.
One 250-page Register, in hands of Committee of Arrangements (Buffalo).
One Ledger of Accounts.
One Register of Members.
One Register of Vol. IV. (names of parties to whom sent.)
450 Blank Applications for Membership.
50 Printed Cards, Mr. R. C. Hill, Secretary, Hotel Accommodations.
150 Preliminary Announcements.
400 Sheets Letter Heads (blue).
100 No. 10 Envelopes (white).
192 Sheets of Wrapping Paper.
50 Mailing Tubes for Diplomas.
125 Slips, Express prepaid, printed-matter rate.
27 Bill Heads, Ass'n in acct. with Secretary.
25 Bill Heads, Secretary in acct. with Association.
Three bundles of Wrapping Cord.
130 Blue Slips, Price of Transactions.
25 Yellow Slips, Price of Volume IV.
50 White Slips on cardboard, price of Vol. IV.
35 Slips Advertising Rates.
93 Slips, Board of Censors (blue).
29 Yards of Official Ribbon for Badge.
57 Copies of the Roster and Index.
63 Constitutions and Index.
200 Medical Journal Prospectus.
18 Inches Official Diploma Ribbon.
138 Blank Diplomas.

PROCEEDINGS.

357 Copies of Volume I., 1891.
149 Copies of Volume II., 1892.
87 Copies of Volume III., 1893.
299 Copies of Volume IV., 1894.

LIST OF ELECTROS AND HALF-TONES.

1. Robert B. Jessup, half-tone.
2. John Henry Murphy, half-tone.
3. "First Aid from Behind the Line of Battle," half-tone. (Senn.) N. Y.
4. First Dressing Station, half-tone. (Senn.) N. Y.

TREASURER'S REPORT.

Covering period from May 1, 1894, to May 1, 1895.

CINCINNATI. OHIO, May 15, 1895.

TO THE ASSOCIATION OF MILITARY SURGEONS OF THE UNITED STATES:

Mr. President and Gentlemen—I have the honor to submit the following report of finances, from May 1, 1894, to May 1, 1895, both dates inclusive:

RECEIPTS.

From members,	$1,440 00	
From advertisers,	920 50	
From sale of ribbons, proceedings, donations, etc.,	103 49	
From phenique,	50 00	
		$2,513 99

EXPENSES.

Refunded by order,	$44 00	
Refunded to Col. Senn on debt and credit in cash,	55 00	
Refunded to Col. Chancellor,	55 00	
Refunded cash to Maj. Briggs,	17 00	
Refunded expenses of Treasurer,	149 80	
Refunded expense of Secretary,	578 59	
To Buxton & Skinner, by order from Secretary and for Proceedings (note),	1,523 30	
	3 50	
		2,425 91
Still due Buxton & Skinner,	$386 25	
Still due Col. Senn,	150 00	
Still due Lieut.-Col. Chancellor,	240 00	
Still due Lieut.-Col. Chencellor for rent,	70 00	
Still due for typewriter,	85 00	
Deficit,		931 42
Balance on hand,	$88 08	
Collected since May 1 (estimated),	100 00	
Total deficit,		743 34

I found, in looking over my books, that eight honorary members had paid annual dues at the Washington meeting without being requested to do so. Looking further, I found that Article XIV. of the Constitution requires dues of honorary members. In accordance therewith I sent statements to the balance residing in America; so, after much correspondence, some pleasant, and more decidedly otherwise, I succeeded in collecting dues from all but four, whose names appear in the report handed to the Auditing Committee.

Even a desire to obey the provisions of the Constitution, and increase the funds in our exchequer, did not induce me to assail Norway, Sweden, Denmark, Spain, Italy, etc., for I have the pardonable desire to understand what a correspondent has to say to me in his answer. I had some hopes of Germany, but my limited knowledge of that language made it plain that they could swear harder in German than they do in English, so I refrained from attacking a foreign shore, as I had my hands full at home.

Some action is necessary in regard to this matter, and if it be the will of the Association to refund honorary members the amounts paid, I have the funds on hand to do so.

DELINQUENTS.

Four communications have been sent to all who are now delinquent.

1 could not be found (letter returned), due, ...		$22 00
5 resigned, due, ...		32 00
3 say they will pay, due, ...		30 00
4 honorary members unpaid, due, ...		20 00
6 say they can not pay, due, ...		120 00
42 have failed to answer four communications; of these—		
5 owe for and from	1891	
9 owe for and from	1892	
16 owe for and from	1893	
(Three of the above owe $3.00 each.)		
42 owe for	1894	
5 owe $22.00 each, ...	$110 00	
4 owe $17.00 each, ...	68 00	
4 owe $15.00 each, ...	60 00	
3 owe $13.00 each, ...	39 00	
26 owe $10.00 each, ...	260 00	
		537 00

Amounts due from delinquents,	$22 00	
" " " "	32 00	
" " " "	30 00	
" " " "	20 00	
" " " "	120 00	
" " " "	537 00	
Total,		$761 00

Of this sum I do not judge more than $200.00 to be possible of collection.

I have now on the books 350 names which I consider in good standing.

These owe for 1895,	$1,275 00
From which subtract our deficit, and we have,	490 00
And the possible,	200 00
Total available assets,	$690 00
From this we must subtract dues paid by honorary members, if ordered to return the same,	95 00
Grand total,	$585 00

As bills for 1896 should be sent out the first of that year, and some constitutional requirement should be enacted to make the same payable promptly, we may raise $1,000.00 in this manner by the end of January, 1896, which would make our assets, say $1,600.00. On this estimate it will be well for the Committee on Journal to figure.

If the Association be to no other cost but $2 per member, this outlay can not exceed $750, and by close curtailment in the offices of Secretary and Treasurer we will be able to weather the storm. I am also estimating that our good friends, Col. Senn ($150) and Lieut.-Col. Chancellor ($395.17), (a total of $545.17), will not crowd us for payment, but leave it as working capital, although these debts should have been paid long ago, and I deem it no more than just that some consideration should be allowed these loans. With this still in our hands, I can easily estimate $1,130 as our working capital, independent of any help from 1896.

DISPUTED ACCOUNTS.

Not considering the forty-two members who failed to answer my communications, there are but five accounts in dispute. Three I

have taken the liberty of settling on my own responsibility, the other two will be referred to the proper committee.

Of the unanswered letters, but six could possibly dispute their accounts. With these exceptions, the books are now in good shape.

JOURNAL.

I stated at our last meeting that to continue to publish our Proceedings would find us here with at least $1,500 in our Treasury. This was my only reason for opposing launching the journal. My reasoning was faulty, from the fact that I based my calculations upon previous figures, to wit: In 1893–94 the publication of our proceedings cost $483.30, while in 1894–95 it was $1,900.25.

This one item alone made it clear to me that our expense current must be estimated from at least as safe and stable a basis as our income. The Journal Committee promise us this, and I am heartily in favor of the trial; but we must bear in mind that, with as much accuracy as such a matter can be determined, we must know the outer limit of our expenses for the ensuing year.

Respectfully submitted,

Lawrence C. Carr, *Treasurer.*

REPORT OF THE COMMITTEE ON BADGE AND SEAL.

MR. PRESIDENT AND GENTLEMEN OF THE ASSOCIATION:

As the badge and seals, as now used, were accepted at the last meeting by the Association as "official," the Committee on Badge and Seal has but little else to report, except the acceptance of more official ribbon for badges, and a thinner grade of same pattern for use on new Certificates of Membership. It is gratifying to the Committee to note the necessity that existed for more ribbon for these purposes, as this signifies the healthy growth of the Association.

The matter of a "testimonial" to one of our members was also referred to this Committee for their judgment and opinion, which was respectfully referred back to the special committee having the matter in charge, as being entirely competent to deal with it.

The Committee respectfully recommend that the same protection be given to the official button by the Association as that accorded the official badge, and that the button can only be obtained by those who are entitled to it, by application to the Secretary of the Association, in the same manner as for the badge.

The official makers of the badge, Mermod & Jaccard Jewelry Co., of St. Louis, Mo., have promised to alter any of the old and now obsolete badges to the new and official form, without any expense whatever to the member owning it, except the cost of transportation to and from the makers, which is to be paid by the member requiring the alterations, and the Committee see no valid reason why all members should not possess an official badge, if not a button also, although the latter may not be so important.

C. M. WOODWARD, *Chairman.*
COL. B. J. D. IRWIN, U. S. A.

REPORT OF COMMITTEE ON UNITED SERVICE MEDICAL JOURNAL.

The Journal Committee has the honor to report that during the past year it has endeavored to carry out the purpose of its appointment in every possible way. In achieving this object, it has made careful studies of—

1. The advantage or disadvantage of special journalism.
2. The comparative advantages of the annual volume of proceedings, and the publication at more frequent intervals.
3. The special advantage or disadvantage to be gained by this Association in changing from the annual to the monthly form.
4. The feeling toward the journalizing of the Proceedings on the part of the members of the Association.

The advantage of organization is so completely acknowledged in these days that it may be admitted at the outset. The formation of this Association is itself an indisputable recognition of this fact. A review of the periodical literature of the day showed that, with hardly an exception, not only every medical specialty, but every trade, occupation, and profession was represented by journals devoted to its interests. Grocers and builders, butchers and tailors, dressmakers and shoemakers, gardeners and hatters, midwives and undertakers alike, find the issue of special periodical publications of great advantage.

Coming down to the medical profession, we find the condition still more accentuated. Gynecology is represented by numerous journals, several of them of the highest type. Surgery has numerous representatives—the eye, the ear, the throat, and nose all find special journals for their consideration, and even the anus is not without its special exponent. Nervous, venereal, and cutaneous diseases, sanitation and hygiene, all have special organs. Anatomy, physiology, histology, materia medica, and chemistry do not lack jour-

nalistic representation. Military medicine and surgery, alone, is unrepresented.

In military literature a similar condition prevails. Each of the three arms of the line of the regular service has its journal, while those specially devoted to the National Guard are the most numerous of all. But the medical department, in which change and progress are more constant factors than in any of the others, has none. This unanimous predilection in favor of special professional publications can not be without reason. The cause, indeed, may be found in the very conditions which have determined the division of the practice of medicine into specialties, or the separation of the military body into arms and departments.

So broad has the field of medical study become with the growth of knowledge, that no man, however capable, can master the whole in all its details. The brightest minds find ample occupation in a single branch of the great subject. A medical Admirable Crichton is an impossible phenomenon. The same conditions prevail in medical journalism. The general medical journal, as embodied in the magnificent examples issued weekly and monthly in several of our large cities, has a place beyond dispute. But general medical journalism can not properly represent medical specialism. To present sufficient matter pertaining to each specialty would require a general journal's enlargement to such an extent as to make it unwieldy, unprofitable, and unattractive. The technical matter pertaining to each special branch would be appreciated by a very small portion of the journal's readers, and to the large remainder it would be unwelcome and distasteful.

The special medical journal, however, with a clientele only of those interested in its own particular field, is able to avoid these difficulties. Appealing only to specialists, it can not become too technical, and devoted especially to a limited field it is enabled the more readily to extract the material that is useful to its readers, and to lay before them a more comprehensive view of the *status quo* of its particular field.

The Association of Military Surgeons has already, by its four annual volumes of proceedings, committed itself in favor of the publication of its literary work in periodical form, which obviates the necessity of discussion of the desirability of a periodical publica-

tion devoted to the interests for the propagandism of which t. Association was organized.

The annual volume has the advantage of presenting, at one time in a compact form, the work of the various annual meetings; but, on the other hand, it has the disadvantage of referring only to the annual meeting, and of not contributing to the advancement of the objects of the Association in the intervals. To produce the best results it is necessary that the Association be kept continually alive, and that there be no cooling of enthusiasm in the intervals between the annual meetings. More frequent meetings are impracticable, but the publication of the work of the Association at more frequent intervals will provide an excellent substitute, by bringing the thoughts of the members to the same points at the same time—providing a simultaneous meeting in thought, if not in body. While only a minority of the members are able to be present in person at the annual meetings, the issue of the monthly journal will practically give us twelve monthly meetings, in which every member can participate.

Under the present plan we have secured the assemblage into single volumes, issued at long intervals, of the work of our own members, and the establishment of an authoritative collection of medico-military literature. But, by the expansion of the annual proceedings into a monthly journal, we shall gain many other advantages, which may be briefly summarized as:

1. The collection, sifting and grouping, of the military medical literature of the day, wherever it may be dispersed, in addition to the work of our own men.

2. The scientific stimulation of the military side of the medical profession, by affording to its practitioner not only a presentation of the best thought of other workers in the same field, but also a vehicle for the prompt expression of his own views.

3. The investment of the future work of American medical officers with the progressive character only to be gained from the existence of an accessible and permanent record of the work of their predecessors.

4. A contact of thought as the best substitute available to the medical officer, for the personal contact so beneficial to the civilian physician, but ordinarily denied to his confrere of the public ser-

ces by the isolation commonly inherent in his occupation. In this way members of the Association, debarred from attendance on its meetings, will be kept *en rapport* with its work nearly as completely as their more favored associates—a fact that will contribute largely to an increase of membership.

5. The better-sustained interest in medico-military topics maintained by publication at more frequent intervals. The monthly reminder, furnished by the appearance of a monthly journal, will keep the best phase of his specialty constantly before the medical officer, while enthusiasm readily gives way to apathy in the long intervals between annual volumes of proceedings.

6. The possibility of timely discussions of current topics of interest to medical officers, a feature that is impracticable in an annual volume.

7. The reduction to the Association in the cost of publication, and the possible income to be derived from the subscriptions of persons not members of the Association, and from a monthly advertising patronage. In the experience of similar associations, publications of this sort have been a source of positive revenue. The Journal of the Military Service Institution is a conspicuous instance of this.

8. The higher position in the profession conceded to a specialty sufficiently virile and enthusiastic to produce and support an active literature of its own. Many other equally cogent reasons might be adduced in favor of the journal plan of publication, but it is believed that those already cited are abundantly ample to demonstrate the enormous advantage that would be derived from it.

In order to obtain the sense of the Association with regard to the publication of the journal, the Committee, during the past Winter, sent to each member a letter, asking for an expression of opinion upon the subject. One hundred and eighty replies were received, as follows:

For a monthly United Service Medical Journal	156
For a monthly "Military" Medical Journal	1
Doubtful	5
Opposed to a United Service Medical Journal	18

In addition to the simple statements of opinion, the Committee received a number of letters heartily indorsing the proposed plan of

publication. Many members emphasized their favorable opin. Six were "heartily," four were "much," two were "decidedly" favor of the journal, and two expressed their enthusiasm in sm capitals, viz: "I AM in favor." Others expressed themselves "most heartily," "sure," "very much," "greatly," "strongly, and "enthusiastically" in favor of the monthly United Service Medical Journal, while two indorsed their votes respectively with "I am converted, and "may success attend you." These votes, duly signed, are presented herewith.

The Treasurer, Major Carr, at whose request, it will be remembered, the matter of the journal was laid upon the table until the present meeting; also writes: "I am now at heart decidedly in favor of the journal."

While this overwhelming vote in favor of the journal, as proposed by the Committee, was exceedingly gratifying to it as an indorsement of its position, it was even more pleasing as an assurance of the disposition of the members of the Association to adopt every measure tending to the advancement of the medical department of the public services.

In order to ascertain how the journal would be received in official circles, the Committee called in person upon the Surgeon-Generals of the Army, Navy and Marine Hospital Service, and learned from them that, if the journal were inaugurated, they would wish to subscribe for a considerable quantity for the officers of their departments.

The question of literary supply for the journal was not regarded by the Committee as at all doubtful. Several years ago a letter was written from the office of the Surgeon-General to every officer of the Army Medical Department, inquiring if, in the event of the inauguration of a journal such as is proposed, the officers addressed would be willing to contribute one or more articles to its pages annually. The replies received were overwhelmingly in the affirmative. The ready response with which the call is received for papers to be read at the annual meeting of the Association, is indisputable evidence of the wealth of suitable material at the command of the journal. The magnificent volume of the Proceedings of the last meeting is itself a monument to the abundance of material available. And, moreover, the very publication of the journal will prove a powerful

mulant to the prosecution of literary work upon the part of the icers of the public services.

In order to ascertain the probable pecuniary position of the journal, the Committee addressed the following letter to a number of esponsible publishing houses:

"This Association has in view the inauguration of a monthly journal, to be devoted to the interests of the Medical Departments of the Army, Navy, Marine Hospital Service, and the National Guard or State militia. The periodical will probably be called the United Service Medical Journal. The subscription list will consist of the members of the Association, for each of whom the subscription will be paid by the Treasurer. The Surgeon-Generals of the Army, Navy, and Marine Hospital Service have stated to the Committee that they would wish to subscribe also for sufficient copies for their respective corps. The journal, then, would probably start with the following remarkable paid subscription list:

Association Military Surgeons,	400
Medical Department U. S. Army,	125
Medical Department U. S. Navy,	50
Total,	700

"It is believed that this list will also be largely increased by subscriptions from others than members of the above-named organizations.

"The character of the readers of the journal will be such as to make it of especial value as an advertising medium, since it will reach both medical and military men, and will, consequently, derive its advertising patronage from those who wish to reach both classes. It will not only reach men of large clientele and professional influence, but also who are actively interested in the purchase of large quantities of medical food supplies, clothing, arms, and similar articles.

"The liberal advertising patronage given to its annual volume of transactions by medical advertisers alone, with but little effort at solicitation, is an excellent indication of the readiness with which such support will come to it.

"We have mentioned the foregoing facts to show that the journal should be a productive enterprise from the beginning, preliminary to the statement that the Committee desires to receive a proposition with regard to the publication of the journal, with which they may go before the Association and secure its assent to the final arrangements.

"It has been suggested that a proposition to publish the journal, as furnished by the Association, the profits to be divided annually upon such a basis as may be determined upon between the Association and the publisher, would probably be the plan of publication most satisfactory to both parties in the end.

"The journal should consist of twelve monthly numbers per annu not more than sixty pages, of the size of the present Proceedings — sa enclosed — exclusive of advertisements and cover, printed upon good p in small pica and long primer type, and with such illustrations as ma necessary to elucidate the text. A subscription price of three dollars a has also been suggested, with a suitable reduction to clubs.

"We should like very much to receive a proposal from you, based u the facts stated above.

"If you should desire any additional data than that given, we shall very glad to furnish it, and meanwhile remain, very sincerely yours."

In response to these letters, replies, as appended to this report were received from:

L. R. HAMERSLEY, Philadelphia.
THE F. A. DAVIS CO., Chicago.
GEORGE S. DAVIS, Detroit.
THE MILITARY-NAVAL PUBLISHING CO., New York.
W. L. & F. P. CHURCH, New York.

Each of these houses made practically the same proposition, viz.: To publish the journal as stated, upon a basis of equal division of profit and loss, each estimating that while profits for the first year would probably be small, there would be no loss. The Committee, by a conservative consideration of the subject, reached the same conclusion. It will be seen that several firms of high commercial standing are ready to proceed with the publication of the journal at once, upon terms entirely advantageous to the Association.

As a result then, of its consideration of the subject during the past year, and summarized in this report, the Committee has arrived at the conclusion that: The change from annual proceedings to monthly journal will be of great advantage to the Association:

1 From a literary standpoint, by the increase and development of the literature of its subject, as recapitulated in this report.

2. From the standpoint of growth, by increase of membership sure to follow the greater publicity and popularity provided by the publication of the journal.

3. From a pecuniary standpoint, by the increase from the division of the journal's profits, and from the fees of additional members.

The Committee then presents for adoption the following resolutions:

Resolved, That the Association authorize the Committee on Medical ıal to proceed at once with the publication of a United Service Medical nal, and to make a contract for such publication with the publisher who offer terms of division of profits most advantageous to the Association.

:. That the Association authorize the Treasurer to subscribe for one y per year of such journal for each member of the Association; provided,

a. That proceedings of its meetings are properly published.

b. That the Association be given a reduced subscription rate, of not more an $2.50 yer copy, and (*c*) that the Medical Journal Committee be allowed censorship over all advertising matter in its pages.

3. That each member of the Association, who shall indicate his wish in :dvance, shall be entitled to a reprint of that portion of the journal contain- ıng the proceedings of the annual meeting of the Association at actual cost.

J. WILKES O'NEILL,
JAMES E. PILCHER.

OFFICIAL RECOGNITION OF THE BADGE.

TO THE PRESIDENT AND MEMBERS OF THE ASSOCIATION OF MILITARY SURGEONS OF THE UNITED STATES:

Gentlemen — The Committee to whom was referred the matter of Official Recognition of the Badge, would respectfully report: That they prepared a joint resolution, which was introduced in the Fifty-third Congress by Mr. Caruth, of Kentucky, under the title of House Resolution No. 171. This was ordered printed and referred to the Committee on Military Affairs, where it was smothered under the pressure of other public business.

Your Committee also addressed a personal letter to the Adjutant-Generals of every State and Territory, asking that if there was not an existing regulation in their State authorizing the wearing of the badge, that an order be issued to that effect.

To this request the Adjutant-General of the following States made favorable reply, to-wit: Massachusetts, Rhode Island, Delaware, Kentucky, Wisconsin, New Hampshire, District of Columbia, Iowa, Colorado, and State of Washington.

The States which have not been named have not been heard from. Your Committee recommend that the Committee on Official Recognition of Badge be made a permanent Committee of the Association until such time as its necessity shall cease.

Though not strictly in line of the duty assigned us, the Committee also recommend that the Badge of the Association be copyrighted, to prevent its use without authority.

Respectfully submitted,

EDWARD J. FORSTER,
Surgeon-General, Massachusetts.

JOHN VAN R. HOFF,
Major-Surgeon, U. S. A.

THOS. GRANT PAGE,
Captain.

General Order No. 7.

ADJUTANT-GENERAL'S OFFICE,
STATE OF COLORADO.
DENVER, APRIL 13, 1895.

The Association of Military Surgeons of the United States being composed of officers of the U. S. Army, Navy, and the National Guard, with the object of furthering the interests of the service by giving the Nation and the States the best professional skill in time of need, officers of the National Guard of Colorado, who may be members of the Association, will wear its Official Badge on all occasions of ceremony.

By Command of the Governor,
CASSIUS M. MOSES,
Adjutant-General.

FIFTY-THIRD CONGRESS, 2D SESSION. H. RES. 171.

IN THE HOUSE OF REPRESENTATIVES,

MAY 3, 1894.

Referred to the Committee on Military Affairs, and ordered to be printed.

Mr. Caruth introduced the following joint resolution:

JOINT RESOLUTION

Relative to the officers of the Medical Corps of the Army and Navy.

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That all officers of the Medical Corps of the Army and Navy, who may be members of the Association of Military Surgeons of the United States, are hereby authorized to wear the badge of that Association on all occasions of ceremony.

REPORT OF THE COMMITTEE ON LEGISLATION.

Mr. President and Gentlemen of the Association:

Two years ago your Committee made some effort to gain an establishment, in each State in which there is a National Guard, of a Medical Department and Hospital Corps, that should be uniform in its organization. This effort, made with the authorities in the various States, elicited the fact that such authorities were desirous that this Association of Military Surgeons should specify exactly what was needed, by drafting a plan of organization of a Medical Department for the National Guard in the different States, that might be adopted by each State, or, by slight or unimportant changes, adapting such plan to the existing laws in States where such changes might be required, and would recommend that a committee be appointed to consider this whole matter, and draft a plan or scheme of organization, to present to the various legislatures or assemblies, in the different States, urging the passage of such a bill. Your Committee has, for the past year, maintained a condition of "masterly inactivity," owing partly to the general financial depression of the country, making it extremely doubtful if any State would entertain a proposition that would have the least appearance of increasing, in any degree, the public expense. And it was thought that the finances of the Association for the present year would not permit of the outlay that would have been required, for printing and postage, to carry out the scheme. It has, therefore, been thought best to allow this matter to come regularly before this Association for its action, and for the appointment of a committee to draft a plan of organization for Medical Departments in the various States, and to receive such other instruction from this Association in this connection as may be thought necessary.

At a suitable time the Chairman of the Committee on Legislation addressed a letter to an honorable United States Senator, relative to certain legislative matters connected with this Association, and

received a reply that Congress was *so busy* with matters connected with the *tariff*, that it was doubtful if they would have time to attend to anything else. So much of the legislation for the welfare of the Association could not be taken up, and the efforts of your Committee in this direction were handicapped. Legislation for the legalization and protection of the official badge of the Association, and permitting it to be worn on occasions of ceremony by officers in the medical military service, has yet to be considered, as well as the securing to officers of the Medical Departments of the National Guard the same benefits from the Army Medical School as those accorded to appointees to the Army Medical Service, and the same with relation to the Naval Medical School and the medical officers of the Naval Reserve. It is hoped this may yet be accomplished. It is further recommended that the authorities in each State be urged to establish a "retired list," so that officers who leave the service, by being retired, or on account of political changes, may be kept in touch with the officers in active service, and for further service in times of emergency.

C. M. WOODWARD,
Chairman.

REPORT OF THE COMMITTEE ON LITTER.

As stated on page xxiv of the Proceedings of the Fourth Annual Meeting of the Association of Military Surgeons of the United States, during the session of May 1, 1894, "On motion of Major Carr, which prevailed, the President was authorized to appoint a Committee on Litter (of three), to investigate the most practicable and useful litter extant, and report at the next annual meeting;" and the Committee appointed in accordance therewith was evidently selected because each of the officers constituting it had himself proposed a special form of litter, that of Medical-Director Gihon, U. S. Navy, the Chairman, however, being particularly designed for the transportation of the sick and wounded on board ships. A moment's reflection would have made it self-evident that these officers were specially unfitted for the duty assigned them, since the stronger and more earnest the conviction of each that his particular litter was the desideratum, the less disposed would he naturally be to recognize superior merit in any other's apparatus. Crediting them, however, with an unparalleled degree of self-abnegation, they found themselves powerless to conduct the investigations proposed through the omission to provide the necessary financial means for assembling, obtaining specimens of the litters extant, and ascertaining, conjointly by experimental trials, which of them was actually "the most practicable and useful," since, only by such *experimenta crucis* is it possible to arrive at such a just conclusion as is alone of any value. The Committee, whose members reside in Boston, New York, and Washington, has, consequently, not been able to meet, nor have its members had, in their profession for individual experimentation, and as a basis of opinion, any other than their own respective apparatus.

Although the resolution authorizing the Committee contemplated only the investigation of "the most practical and useful litter ex-

tant,'' the Committee assumed a wider field of endeavor, and issued the following circular :

TO MILITARY AND NAVAL MEDICAL OFFICERS:

The undersigned, members of the Committee on Litter, appointed by the Association of Military Surgeons of the United States, to report at the approaching annual session, at Buffalo, N. Y., May 21-23, 1895, a desirable form of military litter for the comfortable, safe, and expeditious transportation of the sick and wounded, solicit from medical officers of the national service, and the National Guard of the several States, suggestions, plans, and models of such an appliance, to be delivered to either of them, at their respective addresses, on or before the 1st day of April, 1895.

ALBERT L. GIHON,
Medical Director, U. S. Navy,
U.S. Naval Hospital, Washington, D. C.

JOHN VAN R. HOFF,
Major and Surgeon, U. S A.,
Governor's Island, Harbor of New York.

MYLES STANDISH,
Captain and Assistant Surgeon, M. V. M.,
200 Dartmouth Street, Boston, Mass.

In response to this solicitation, descriptions and plans were received from the following officers:

1. Litter, devised by Major William E. Spencer, Surgeon, 23d Regiment, N. G. N. Y.
2. Litter, devised by Major E. T. T. Marsh, Surgeon, 71st Regiment, N. G. N. Y.
3. Pneumatic stretcher-litter, devised by Surgeon J. D. Menzies, Royal Navy, H. M. S. "Sharp-shooter," Channel Squadron, Gibraltar.
4. Truss-litter, devised by Capt. W. O. Owen, Jr., Assistant Surgeon, U. S. A.; Post Surgeon, Fort Bayard, New Mexico, Department of Colorado.
5. Adjustable litter-truck, divised by First-Lieut. Henry R. Stiles, Assistant Surgeon, U. S. A., Middletown, Conn.
6. Wheel-stretcher, devised by David W. Graham, M. D., Chicago, Ill.
7. The Johnstone army stretcher, by civilian Hampden Johnstone, member of the Red Cross Society, 1886.
8. The Mexican stretcher, devised by Dr. R. Ortega, Facultad de Mexico, Ciudad Perfirio Diaz, Coahuila, Mexico.
9. Litter, devised by Major Washington Matthews, Surgeon, U. S. A., Washington, D. C., of which a half-size model was exhibited to the Chairman of the Committee, and which it is expected will arrive in time for presentation before the Association.

Major John Van R. Hoff, Surgeon, U. S. Army, of the Committee, also submitted to his associates plans and specifications for a proposed telescoping-handle litter, to meet all requirements of such an apparatus in the U. S. Army, designed and presented by him in 1891.

Col. Charles H. Alden, Assistant Surg.-Gen. U. S., Army, replied to the Committee's circular letter as follows:

WAR DEPARTMENT, SURGEON GENERAL'S OFFICE.
WASHINGTON, February 19, 1895.

MEDICAL-DIRECTOR ALBERT L. GIHON, U. S. NAVY, Second Vice-President, Association of Military Surgeons, U. S., Chairman Committee on Litter, U. S. Naval Hospital, Washington, D. C.:

Sir—I am directed by the Surgeon-General to acknowledge the receipt of your letter of February 17th and enclosed circular, and to inform you that modification of the present standard litter of the Medical Department of the Army is now being prepared, and will shortly be ready for practical test. Samples of this litter will, no doubt, be available for examination at the approaching annual meeting of the Association in May, in Buffalo.

Very respectfully, C. H. ALDEN,
Asst. Surg.-Gen., U. S. Army.

Four days after, the following communication was received from the office of the Surgeon-General of the Army:

WAR DEPARTMENT, SURGEON-GENERAL'S OFFICE.
WASHINGTON, May 15, 1895.

MEDICAL-DIRECTOR A. L. GIHON, U. S. NAVY, Chairman Committee on Litter, Association of Military Surgeons of the U. S., Naval Hospital, Washington, D. C.:

Dear Sir—I am directed by the Surgeon-General to inform you that a sample of the U. S. Army litter, model of 1895, with slings, has been forwarded this day by express, addressed to Mr. R. C. Hill, Secretary of the Executive Committee, Hotel Iroquois, Buffalo, New York.

The litter was sent to Mr. Hill at that address, as the Hotel Iroquois is the headquarters of the Association in Buffalo.

The litter is placed at the disposal of your Committee for exhibition at the May meeting of the Association, and it is requested that it may, with the two slings belonging to it, be returned to this office by express (charges to be paid here), at the close of the meeting.

Very respectfully, C. H. ALDEN,
Asst. Surg.-Gen., U. S. Army.

Besides these devices herewith submitted, the following, published in the volume of the Proceedings of the Fourth Annual Meeting, in the year 1894, are entitled to be considered with them:

1. Litter proposed by Col. Nicholas Senn, Surgeon-General, N. G. Ill., President of the Association of Military Surgeons of the United States. (Page 11.)

2. Litter proposed by Capt. Myles Standish, Assistant Surgeon, M. V. M. (Page 58.)

3. Litter for military use, proposed by Capt. Frances J. Ives, Assistant Surgeon, U. S. Army. (Page 63.)

4. The travois, described by Major John Van R. Hoff, Surgeon, U. S. Army. (Page 73.)

5. Naval ambulance cot, devised by Medical-Director Albert L. Gihon, U. S. Navy. (Page 96.)

6. British army litter, described by Lieut.-Col. Alfred A. Woodhull, Deputy Surgeon-General, U. S. Army. (Page 597.)

Attention is further invited to a historical sketch of other kinds of the military hand-litter, by Major Van R. Hoff, Surgeon U. S. Army, published in the Journal of the Military Service Institution for May, 1894.

The Committee, having had neither time nor opportunity for inspection, critical examination, or conference, does not feel justified in discussing the subject in a report to the Association in the necessarily imperfect manner only possible, and it, therefore, suggests as the only feasible means for the critical comparison, by actual trial of the several apparatus presented and referred to, except by the expenditure of a considerable sum of money, that the Surgeon-General of the Army and Navy be requested to convene a joint Board of Medical Officers of the two services, before which Medical Officers of the Army, Navy, National Guard, and others interested in the matter shall be invited to present the various devices advocated by them for uniform and exhaustive tests as to their relative merits, and that of the army-litter of 1895; and for decision as to the one best fitted for military requirements, which shall then be further submitted to the Surgeon-General of the National Guard of the several States, with such approval, in order that an apparatus for general use throughout the entire country may be selected. The Committee believes that in no other way can the proposed investigation be conducted thoroughly, satisfactorily and justly, and beg to be discharged from its further consideration.

All which is respectfully submitted,

ALBERT L. GIHON,
Medical Director, U. S. Navy.

JOHN VAN R. HOFF,
Major-Surgeon, U. S. A.

MYLES STANDISH,
Captain Amb. Corps, M. V. M.

REPORT ON U. S. ARMY LITTER, MODEL OF 1895.

WAR DEPARTMENT, SURGEON-GENERAL'S OFFICE.
WASHINGTON, May 13, 1895.

TO THE SURGEON-GENERAL, U. S. ARMY:

General — In accordance with the requirements of your Special Order of May 19, 1894, constituting a board to investigate and report on the form of litter which, in its opinion, is best adapted for use in the Army, in view of economy, simplicity of construction, durability, lightness, and adaptability for the service required, the undersigned members of the board have the honor to report as follows:

On account of the pressure of other business, no meeting of the Board was held up to the time that Major J. C. Merrill, Surgeon, U. S. Army, was relieved from duty in the office, June 30, 1894, and subsequent to that the work of the Board was interrupted by various matters of current business, so that no formal meetings were held on prescribed days, but the members, being on duty in the office, had frequent consultations on the subject.

As the result of their examination of the present litter, they concluded that its main objectionable feature was its weight—twenty-four pounds. It was considered that this weight needlessly burdens the bearer in carrying it any considerable distance, particularly, as the emergency might require his running with it. Of course, in lessening the weight of the litter, its strength would be impaired, but it is believed to be advisable to lessen the weight, and so save the strength of the bearer, even if by so doing the number of litters broken in service should be somewhat increased. They are not so expensive as to make great durability an essential feature.

The Board examined models of Major Hoff, and Major Havard, U. S. Army; a litter devised by Major E. T. T. Marsh, N. Y. S. N. G.; one in use by Massachusetts Volunteer State Militia, and specimens of the litters of England, France, Germany, and other nations, at the Army Medical Museum.

In preparing a new model, as required by the order of May 19, 1894, the Board has not embodied any original features, but has endeavored to reduce the weight of the present litter, while preserving sufficient strength in all its essential parts, some modifications suggested by other litters, particularly the English models, having been adopted. In doing this many experiments were made, and the results tested practically by Capt. Cabell, of the Hospital Corps company at Washington Barracks.

Drawings of the litter now proposed as the model of 1895 are hereto appended, showing: 1. The under surface of the open litter. 2. A side view of

the closed litter. 3. The pole plate and stirrup foot. 4. The cross-brace. 5. The sling.

Weight has been lessened by making the litter poles one and one-half inches wide, instead of one and three-quarters, the depth on which the greatest strain comes remaining one and three-quarters, as formerly. The legs and braces, as will be seen from the specifications, are also considerably lighter than those on the present litter. The stirrup foot is secured to the pole by a single bolt, and kept in place by a flange reaching up from the foot plate about a quarter of an inch on each side of the pole. The foot is of malleable iron; the cross-braces of well-tempered steel. The latter are after the form suggested by Capt. Geo. T. Beall, U. S. Army (retired), formerly medical storekeeper, but with an important modification, which consists in having a large slot or fenestrum over the joint in the center, so as to prevent choking by dirt or other foreign body. The braces are attached at each end to an extension of the pole plate, somewhat after the manner of their attachment in the English litter. A large-headed bolt riveted to this plate prevents motion of the brace, except in the direction of flexion and extension, and a stop on the outside keeps the brace from swinging out in closing the litter.

The canvas of the new model is practically the same as that of the present litter, but it is so secured to the outside of the poles that the surface of the canvas and heads of the tacks are flush with the wood, as is also the outer edge of the foot plates. The straps that fasten the litter when closed, are attached by two studs; and when the litter is open and these straps are not in use, each is put out of the way by being stretched along the under surface of the poles, and slipped over another stud near the handle.

The weight of the new model is sixteen and one-half pounds, as compared with twenty-four pounds, the weight of the present litter.

One of the defects of the present litter, in the opinion of many who have used it, is the permanent attachment of the slings to the poles. Slings, if so attached, not only increase its weight when carried, which, perhaps, is a small matter, but they are in the way. When the slings are taken off the shoulders of the bearers they are liable to get entangled in passing obstacles and underbrush, and are inconvenient when the litter is being put into the ambulance. The chief argument for the attached slings is that they are always on hand with the litter when wanted. This is certainly a great desideratum, but it is believed that it does not counterbalance the disadvantages. The slings for the new model are to be carried by the bearer as a part of his personal equipment. They are made of dark blue worsted webbing, two and one-half inches wide, adjustable to the height of the bearer by a sliding buckle at one side, provided with a loop lined with leather at each end. The bearer, when not using the slings, slips its ends inside his belt to keep them out of the way. No reason is seen why the presence of the slings can not always be secured by proper inspection of the bearers when they file out for duty. The slings, for short distances and light burdens, may not be used at

all, but the importance of having them for long distances and heavy burdens would, it is believed, so impress itself upou all bearers by actual experience, that, irrespective of orders to that effect, they would not fail to keep them as a part of their equipment.

The model of 1895 has beeu tried so far as to demonstrate its practicability and strength. It is not believed, nor is it supposed, that it will bear quite as much weight or hard usage as the one now in use; but, as already stated, it has been considered best to sacrifice a little of the durability of the litter for the sake of the comfort of its bearers.

As yet no proposals have been made for the manufacture of the new model; but there is no reason to believe that it will be any more expensive than the present one, except, possibly, a slight difference extra iu the cost of steel instead of iron braces.

Inquiries from several firms who manufacture aluminum and its alloys show that, while these metals might answer for the legs, they would not be strong enough for the cross-braces. The expense is estimated to be from three to six times that of iron and steel. If aluminum is used for the legs, the weight of the litter would be lightened by considerably more than two pounds.

In view of the increase of cost by using aluminum, it is not deemed advisable to take auy further steps in that direction at present.

Respectfully submitted,

C. H. Alden,
Col. and Asst. Surg.-Gen., U. S. Army.

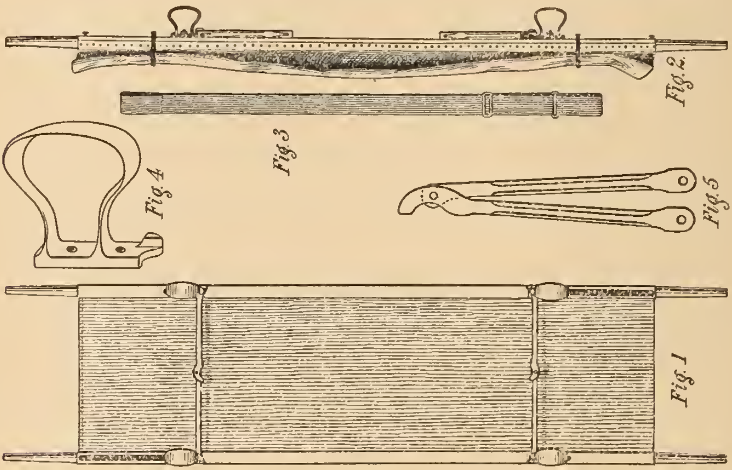
Ch. Smart,
Major and Surg., U. S. Army.

SPECIFICATIONS FOR THE U. S. ARMY LITTER, MODEL OF 1895.

Side poles to be well-seasoued, straight-graiued ash, 7 feet 6 inches long, 1½ inches wide and 1¾ inches deep, with all their angles slightly rounded off, to prevent cutting. The upper part of the outer surface of each pole, at the attachment of the canvas, to be shaved away not more than ⅛ of an inch, so that the surface of the applied canvas, and of the heads of the nails attaching it, shall be flush with the lower and unshaved part of the said surface; and commencing at 9 inches from each end, the pole will be rounded into handles.

The canvas to be strong, 12-ounce cotton duck, dyed dark reddish-brown, 6 feet 2 inches long by 2 feet 2 inches wide. At each end an iuch is to be turned under and sewed down, and at each side an inch is to be turned under and tacked to the shaved surface of the side bar, so that the upper surface of the canvas shall be 6 feet by 22 inches in the clear. Tacks to be of suitable size, and not more than 1 inch apart.

The legs or feet to be of wrought-iron, stirrup-shaped, and to raise the under surface of the poles 4 inches from the ground level. The pole-plate of each leg is 3⅜ inches long, and has on the outer part of the end toward the mid-length of the pole a projection to keep the braces in position when the poles are approximated. The plate is turned up at the sides ¼ of an inch, to grasp the pole, which is here compressed so that the metal is flush with its outer surface. The pole-plate has two apertures, one, ⅝ of an inch in diameter, for the bolt on which the brace or traverse iron plays, the other ⅜ of an inch in diameter between the blades of the stirrup, for securing the whole



to the pole. The loop of the stirrup is 1¾ inches wide near the pole-plate, widening out to 3⅝ inches at its widest part, about ¾ of an inch from the foot-plate. The blades forming the loop are each ⅞ of an inch broad at the neck, expanding to 1⅞ where they conjoin to form the foot-plate, which is somewhat convex in every direction to give a broad support.

The braces are of wrought steel, each consisting of two pieces playing, by their outer ends, on the bolt in their respective pole-plates, and hinged by a bolt at the junction of their inner ends. Each piece is formed of a bar of well-tempered steel, ½ inch wide and 9-16 of an inch deep, grooved longitudinally on four of its aspects to lessen weight without impairing strength. The outer end is flattened to facilitate movement on the pole-plate. The inner end of one projects about an inch beyond that of the other, which it embraces, thus strengthening the joint when the braces are on stretch; and this joint is fenestrated on the back to prevent choking by mud or dirt. From the center of the pole-plate bolt to the center of the rivet which hinges the pieces, each measures 10¼ inches, and the whole, when on the stretch, should make the litter 22 inches wide from outside to outside of the canvas-

covered bars. When the litter is closed the braces project lengthwise toward the center of the litter, immediately beneath the approximated poles.

Four ¼-inch studs are fastened, one each, on the under face of the poles, 1 inch toward the handles from the attachment of the pole-plate. These are for fastening the closed litter by a pliable leather strap, 11 inches by ¾ of an inch, punched with stud holes near the ends, but leaving enough of leather beyond the stud hole at one end to facilitate the fastening and unfastening of the strap. Two other studs to be placed, one in the under surface of one pole near the junction of the handle, and the other at the opposite end of the other pole, each at such distance from the studs first mentioned as is required by the length of the straps, so that when the litter is opened the straps may be fastened beneath the poles.

LITTER SLINGS.—The sling for the new model is to be carried by the bearer as a part of his equipment. It is of strong, dark-blue worsted webbing, 2½ inches wide, and 6 feet long in its greatest length, but adjustable to the height of the bearer by a sliding buckle near one end, and provided at each end with a leather-lined loop to take the handles of the litter.

REPORT OF PUBLICATION COMMITTEE.

The Committee on Publication and Printed Matter beg leave to submit a complete specification of all printed matter contracted for and disposed of on account of the Association by the Secretary, from May 1, 1894, to May 1, 1895.

ENVELOPES.

May 18 — 1,400 No. 10 Envelopes—7 kinds.
June 6 — 1,000 No. 9 Envelopes.
June 6 — 1,000 No. 7 Envelopes.
Oct. 27 — 500 No. 7 Envelopes.
Oct. 27 — 1,000 No. 10 Envelopes.
Nov. 7 — 2,230 No. 10 Envelopes — blue bond paper.
Nov. 8 — 350 No. 10 Envelopes — blue linen.
Nov. 28 — 500 No. 5 Square Envelopes — Journal Committee.
Mar. 25 — 1,000 No. 10 Envelopes.

LETTER HEADS.

May 21 — 2,000 Letter Heads — 2 kinds.
May 21 — 2,500 one-half Letter Heads — blue bond paper.
Apr. 25 — 400 Letter Heads.
June 24 — 500 one-half Cap Letter Heads — on blue bond paper.
Oct. 27 — 1,000 Letter Heads.
Oct. 27 — 500 Letter Heads for Committees.
Nov. 9 — 1,000 Letter Heads — Secretary.
Nov. 9 — 500 Letter Heads for Journal Committee.
Mar. 16 — 1,000 Letter Heads — banker's linen.

SLIPS.

May 24 — 300 Slips—Advertising Rates.
May 24 — 300 Slips—Advertising Contract.
June 12 — 150 Slips—Special Advertising Rates.
Nov. 15 — 750 Slips—Price of Transactions.
Oct. 27 — 500 Red Labels, express prepaid, printed matter mail rates.
Oct. 27 — 500 Notices on Crane's Wedding Stock — Price of Vol. IV.
Oct. 27 — 500 Notices on Card Board — Price of Vol. IV.
Oct. 27 — 250 Slips—Board of Censors.

Oct. 27 — 250 Slips — Office of Secretary.
Mar. 16 — 2,000 Applications for Active Membership.

CARDS.

May 25 — 250 Postal Cards — Prompt recognition of various communications.
Feb. 15 — 350 Postal Cards—Journal Committee.
Mar. 16 — 1,000 Cards — Hotel Accommodation.

BILL HEADS.

July 9 — 400 Bill Heads — three kinds.
July 9 — 400 Bill Heads — three kinds.

CIRCULARS.

May 28 — 100 T. W. Circulars—Adjutant-Generals.
June 28 — 100 Circulars — 4 pages — Official Circular No. 1.
Nov. 10 — 2,500 4-page Official Circular No. 11.
Feb. 19 — 750 Circulars — 2 sheets —Journal Committee.
Mar. 13 — 2,500 Circulars — 4 pages — Preliminary Announcement.

PROCEEDINGS.

July 22 — 500 Copies of Proceedings, Volume I, 1891.
Aug. 1 — 3 Copies of Proceedings, extra bound.
Oct. — 800 Copies of Proceedings, Volume IV, 1894.

MISCELLANEOUS.

Oct. 27 — 400 Copies of Constitution and Index.
Oct. 27 — 100 Copies of Roster — 12 pages.
Oct. 27 — 450 Mailing Boxes — printed.
July 8 — 1,250-page Register of Members — now in Buffalo.

(Signed.) E. CHANCELLOR,
CHAS. B. EWING,
LAWRENCE C. CARR.

ST. LOUIS, MO., May 1, 1895.

REPORT OF COMMITTEE ON THE ORGANIZATION OF THE AMERICAN BRANCH OF THE RED CROSS ASSOCIATION,

AND ITS STATUS IN CONNECTION WITH THE MEDICAL DEPARTMENT OF THE NATIONAL GUARD AND U. S. ARMY.

To a Swiss gentleman, whose name, Henri Dunant, will live in the annals of humanity, we owe the consolidation of the practical sympathies of the world under the flag of the Red Cross. This philanthropist having witnessed something of the sufferings of the wounded at the battle of Solferino in 1859, conceived the idea of a compact among the military nations of Europe by which the wounded and those who cared for them should be officially recognized as protected under a hospital flag common to all. The Swiss Federal Council approved of the suggestion of M. Dunant, and a conference was held in Geneva in 1863, at which the discussion passed beyond the idea enunciated above to the establishment in each country of an association for the relief of the sick and wounded during campaigns — each association to be permanent, and by keeping in touch with the others to form an International Association, the headquarters of which should be the Swiss National Society. The duty of each association was understood to be the establishment of such relations with its government as would enable it to work to advantage when needful, and the preparation in times of peace for service in war by collecting money and stores, educating nurses, testing new inventions intended for the benefit of the sick and wounded, etc. Based on the views expressed at this Conference the Federal Council of Switzerland issued an invitation for an International Convention. This was held at Geneva in August, 1864. Twenty-five members were present, representing sixteen governments. The sessions lasted two weeks, during which the "Articles of the Geneva Convention" were drawn up. In these there is no mention of

national or other associations of voluntary relief. They are purely and simply the embodiment of M. Dunant's ideas of a contract between the armed powers to insure protection to the wounded and to the personnel and supplies of the field hospitals. A red cross on a white ground was suggested as the war hospital flag of the nations and the badge of their medical service.

This, which was adopted as a suitable ensign, was derived, in honor of the part taken by Switzerland in fostering the movement, from the national flag of that country, by interchanging the colors of its cross and field.

The articles of the Convention provided: 1. For the neutrality of ambulance stations and military hospitals, so long as they contain any sick or wounded. 2. For the neutrality of the staff, administrative, and medical officers, attendants, and litter bearers. 3. That the neutrality of these persons shall continue after the occupation of their hospitals by the enemy, so that they may stay or rejoin their corps, as they choose. 4. That if they depart they may take only their private property with them, the equipment of the hospital remaining subject to the laws of war; but an ambulance station or field hospital may be withdrawn with its equipment. 5. That a sick or wounded soldier in a house shall be regarded as a protection to it, entitling the resident who has entertained the soldier from exemption from quartering of troops, and from part of the war requisitions. 6. That wounded men shall be cared for, and when cured, shall be sent back to their own country on condition of not bearing arms during the rest of the war. 7. That hospitals and ambulances (*i. e.*, field hospitals) shall carry, in addition to the flag of their nation, a distinctive and uniform flag, bearing a red cross on a white ground; and that their staff shall wear an arm badge of the same colors (the delivery of the brassard for the arm to be made by the military authorities). 8. That the details concerned in carrying these articles into effect shall be left to the commanders of the armies. The 9th and 10th articles were formal and signatory.

Twelve of the governments represented at the Convention ratified the treaty without delay. As a military result of the acceptance of these articles, the sick and wounded, with the supplies intended for them, receive formal protection under the flag of the Red Cross, and the members of the Army Medical Service of the belligerents perform

their arduous and dangerous duties on the field, protected from intentional injury, and from capture and imprisonment by Red Cross brassard, worn on the left arm, as the official insignia of their status in the military service. To the military surgeon this was the grand achievement of the Convention of Geneva. It was independent of the establishment of civilian aid associations, or of any assistance, either in personnel or material, to be furnished by such associations. It gave the army medical departments of armed nations a clear field for the care of their wounded, and of that of the enemy, if left to be thus cared for; and with the present efficient organization and discipline of medical staff corps, and the liberal appropriations for supplies characteristic of the present time, it is believed that they will ordinarily be competent to do their work on the battle field without civilian assistance.

Aside from the military aspect of the results of the Convention, which, as may be seen from the articles of the treaty, is the only view that can be taken in a formal and official light, the element of civil assistance as discussed at the preliminary conference was subsequently brought in, although forming no part of the treaty except in so far as this element would participate in the neutrality accorded to those who were officially invested with the Red Cross brassard by the proper military authorities. A national Red Cross association was formed in each of the countries that had accepted the articles, and the union of these under the headquarter flag of the Swiss National Association form the International Association. In the event of war, the national association of each of the belligerents was to take the field in the interests of humanity and in aid of their respective army medical departments; and the associations of nations neutral in the quarrel were authorized to contribute to the relief of the wounded by money and supplies, and even by the establishment of flying and permanent hospitals. No mention of Red Cross associations is found in the treaty. The Red Cross of the Geneva Convention is the hospital flag of the nations, and the arm badge the insignia of their hospital personnel; but the sympathies and energies of those who were instrumental in bringing about this result led them to organize these associations to operate under the same flag for the benefit of humanity. The German National Association, under the presidency of the Empress Augusta, did

much to add to the comfort of the sick and wounded in the Sleswick-Holstein campaign of 1866. Again, in the war of 1870, the German branch, by virtue of its earlier experiences, did excellent service in collecting and distributing supplies. The great central depot at Berlin, according to published accounts, comprised seven sections: Camp material, clothing, dressings for wounds, surgical appliances, medicines and disinfectants, food and tobacco, and hospital furnishings. The State offered free transportation for all articles intended for the use of the wounded and sick, and the voluntary contributions of the people kept up the supplies of sanitary material. When stores were started for some point where they were required, agents of the Association accompanied them to hasten their progress and insure their prompt delivery. Money and stores were contributed liberally during this war by other nations belonging to the International Association. Most of these went to the assistance of the French Armies, for, although France had been one of the countries that had been prompt in accepting the articles of the Geneva Convention, its National Association was by no means well prepared for active service at the outbreak of the war.

At the present time forty nations have joined the compact on behalf of the wounded. The wonderful progress of M. Dunant's views may be appreciated by considering an extract from a War Department circular, dated September 22, 1894, for the guidance of the Japanese Army during the progress of hostilities with China:

> Japan became a party to the Red Cross treaty in 1886, and her soldiers have already been instructed that they are bound to treat with kindness and helpfulness such of their enemies as are disabled. China not having joined this treaty, may subject sick or wounded Japanese to merciless treatment. Against such contingencies the Japanese must be on their guard. It is not alone to those disabled by wounds or sickness that merciful and gentle treatment should be extended. Similar treatment is also due to those who offer no resistance to our arms. Even the body of a dead enemy should be treated with respect. Japanese soldiers should always bear in mind the gracious benevolence of our August Sovereign, and should not be more anxious to display courage than charity.

The United States was slow to accept the articles of the treaty. This arose from the disturbed condition of our country at the time of the Convention. We were actively engaged in a great

war. Our government failed to send delegates to the International meeting; our philanthropists had as much as they could attend to at home. Occupied with the work of the sanitary and Christian commissions and state relief societies, they had no time to consider the proceedings of the conference and convention at Geneva. For years after the close of the mighty struggle our people avoided the thought of future war. The war was over, and the sun of peace was shining on the land. There was no cloud above the horizon—nothing to suggest that the efforts of European philanthropists on behalf of the wounded on European battle fields had any particular application for ourselves, separated as we were from them by the broad Atlantic. To this must be attributed our apathy in this great movement of the human race for the protection of the wounded. As a matter of fact, the Geneva Convention attracted so little attention in this country that even Miss Clara Barton, who had been devoted in her attention to the sick and wounded during the war, knew nothing of it for several years after the volunteer aid associations of many European countries had become organized into an International Red Cross Association. It is true that at the second International Convention, held in Paris in 1868, the United States was represented by the Rev. Dr. Henry Bellows, the chief of our Sanitary Commission; but no official action was taken on his presentation of the Articles to the State Department.

But, although the United States was not one of the nations associated under the Red Cross of the Geneva treaty, some of our citizens made an effort during the war of 1870 to show to the military nations of Europe how the field hospitals of our Civil War had been organized and administered. On the sudden outbreak of the Franco-Prussian War the American colony in Paris held a meeting and decided to organize an American Red Cross Hospital. They appointed a committee, of which Dr. Thomas W. Evans was Chairman, to carry their views into effect. Letters were sent to Dr. Bellows, of the Sanitary Commission, asking for aid, but it does not appear that anything was done to bring the matter before the people of this country. On request, the War Department promptly sent hospital tents to the Paris committee, but outside of this Governmental contribution nothing was sent from the United States to

outfit the "American Ambulance." Pending its organization, the German armies closed around Paris, so that, instead of being able to demonstrate on the battle fields of Europe the hospital and ambulance service of our Civil War, the American Red Cross Ambulance had to be converted into an establishment illustrative of our field division hospitals, as they existed during Winter quarters in the Army of the Potomac. Dr. Marion Sims was at first in charge, but during the active service of this American field hospital Dr. John Swinburne was its Chief. As it was the only hospital under canvas in Paris during the siege it attracted considerable attention and favorable comment.

During this same war Miss Barton was an earnest participator in the work of the relief associations in the field. Shortly before the outbreak she became acquainted with the history of the Convention of Geneva, and the excellent results that had been accomplished under its terms, in 1866, by the army medical departments of the belligerents, and under the protection of the Cross by the relief associations. She became filled with the grandeur of the idea, and thenceforth devoted all her energies to bring the United States into official brotherhood with the nations that had accepted the treaty, and to make known to the people of this country the valuable results that had been achieved for humanity by systematized relief under the International compact.

On her return from Europe Miss Barton made several efforts to have the articles of the Geneva Convention officially recognized by the United States Government, but not until March, 1882, was she successful. Incorporated among the articles of the treaty, as accepted by this country, was one which is now known as the "American Amendment," permitting and enjoining work in aid of the victims of great national calamities, as floods, earthquakes, fires, pestilence, and famine. Prior to the acceptance of the treaty by the United States, a National Relief Association was incorporated, at the suggestion of President Garfield, to give strength to the movement toward International union. A copy of the articles of incorporation is appended to this report, from which it will be seen that Dr. Jos. K. Barnes, then Surgeon-General of the Army, was one of the incorporators. Recently, a revised Constitution was adopted, a copy of which is also appended to this report. After

favorable Congressional action on the treaty, the Constitution of this National Association was forwarded, through the State Department, to the International Committee at Geneva, for consideration and acceptance, and thereafter proclamation of the treaty was made by the President of the United States.

The *raison d'être* of the national associations of Europe was help for the wounded in times of war; and the American branch looks forward to rendering valuable service should the tocsin of war be sounded in this country, and our battle-flags be unfurled. But the spirit of humanity and the advance of civilization, which brought the Red Cross into being, have exercised a powerful influence in developing the sanitary services of military nations. The medical departments of armed nations have not stood still in the midst of progress; nor has that of the United States, for this very committee which is now reporting, and the Association of Military Surgeons, which it is now addressing, are proofs of the live and earnest spirit of the medical departments of the Army of the United States and of our State military forces. Every war power has a competent medical staff and a well-drilled and disciplined hospital corps ready for field service; and these operate to better advantage now than formerly, because of their neutral status under the terms of the Geneva Convention. In earlier years many efforts have been made, by military commanders and others, to effect a temporary truce on behalf of the wounded on some battle field, but the time was not ripe for the general acceptance of neutrality for the wounded until M. Dunant raised his voice. On the battle field now under one International hospital flag the disciplined ranks of the Army hospital corps can care for the wounded infinitely better than in the earlier wars of this century, when Percy was organizing his brancardiers and Larrey his ambulances.

To what extent the Military Surgeons of the United States will receive assistance in their efforts, on behalf of the wounded of future wars, from the American Branch of the Red Cross Association, remains for the future to demonstrate. Fortunately, so far, the American Association has had no opportunity of testing its resources during war. Were we to form an opinion from our experience of the work of the Sanitary Commission, and other volunteer aid societies during our Civil War, it would be to the effect that the field on

which the most valuable services of the American Branch will be rendered in time of war will not be the battle field. Years ago one of the members of your committee wrote as follows concerning volunteer aid associations: "If such associations are of value, other than in the moral point of view as expressive of a sympathy strong enough to be practical, the medical arrangements of the army are inefficient, and require reorganization. But even when of value their administration works at a disadvantage. It has necessarily less knowledge of coming events and possible necessities; less experience of army usages, and less influence in military circles than the Medical Department, however imperfect in organization. The good accomplished by the funds of the Association is thus proportionately less for the amount expended than if turned into the hands of the official administration. While as to the personnel: Enthusiasm in individual cases will enable the worker to be of value, but, as a rule, it can not be expected that volunteer aid, subject to no orders and uncertain as to the progress of events, will be as efficient amid the confusion and dangers of the battle field as if subordinate to existing authority, and laboring in co-operation with the system of the department. Possibly in no army could aid societies have had greater consideration paid them by military men than in ours, yet the battle field was not the scene of their best labors, but the base and other sedentary hospitals, where the wounded were treated after the field medical organization had been relieved from their charge. * * * Where the medical department of the army is all it ought to be, volunteer aid societies are, to say the least, needless. Where it is inefficient, they are useful, not so much from the aid they contribute on the battle ground, but as pointing out alike to public officials and public observation the necessity for improved methods. Probably the greatest good effected by our Sanitary Commission during the war was the influence it exercised in liberalizing supplies and hospital accommodations by demonstrating that the country held money as valueless in the face of human suffering." This was written sixteen years ago, and the wisdom that should come to the writer with advancing years has not in any ways tended to alter his views.

It would be unwise to place reliance on volunteer civilian aid in the important and dangerous service of the field ambulances.

Enthusiasm will sustain individual volunteers in times of danger, but it can not be trusted to carry on the co-operative work of an ambulance service. Men trained and disciplined under the iron hand of military control are the only fit instruments for such work. In well-disciplined military commands the potential energy of the company is infinitely stronger than the mere sum of the powers of its individual components. Military cohesion gives increased courage and coolness to the individual, and keeps the command at its post of duty, notwithstanding exposures and losses that would demoralize men having no military training. A company of volunteer civilians is liable to become disintegrated by any unexpected event of an alarming or threatening character, and such events are of common occurrence on the field of battle. Any field work undertaken by the American Red Cross Association would have to be done subject to the military authority, which invests its members with the brassard of recognized neutrality. But this would seldom be required of it by the said authorities, for so long as the field hospitals of an army are intact, and competent to meet the probable needs of a campaign, no commander would add unnecessarily to his impedimenta; and should the field hospitals be weakened by a succession of battles and movements requiring sections of their organization to be left here and there with depots of wounded men, no medical director would leave his hospitals thus broken up, and continue the campaign with untried volunteer aid. He would utilize the volunteer aid in gathering up his scattered sections to resume their proper stations at the front.

The history of the French national association, the Société de Secours aux Blessés, during the Franco-Prussian War gives emphatic support to these views. This society, carried away by enthusiasm, undertook the sole charge of the wounded in the field, as well as in the general hospitals. The headquarters of the French Red Cross Association became the headquarters of governmental aid for the fallen. The medical officers of the army became subordinate to it, as they had formerly been subordinate to the Intendance or Quartermaster's Department, giving their professional services to the sick and wounded, but having no voice in the administration or movements of the field hospitals. To give a formal status to this arrangement, a delegate from the Société de Secours was admitted

to the councils of the national administration. The Society sent ambulance côrps into the field, organized hospitals, and supported all the expenses of these establishments, even to the salaries of surgeons and the wages of nurses. At a later date a governmental decree gave to the Society a franc a day for each soldier under treatment. Concerning the work of the Society, Dr. Edward A. Crane, of the American Red Cross Ambulance, wrote as follows:

Coming into the field as a volunteer organization, forming no essential part of the military hierarchy, largely ignored by the intendance—whose prerogatives it had encroached upon, but upon whom it was necessarily dependent, not only for its information but for its means of moving, and even of existing—the efficiency of the Society was immediately paralyzed by the abnormal and false position it occupied. It was almost constantly ignorant of the necessities of the several armies in the field; it, at least for a long time, neither possessed nor could furnish any exact information on those very subjects a knowledge of which was most essential before any intelligent executive measures could be adopted. Even the position of the different corps and divisions, as well as the means of reaching such sections of the army, was unknown to it. Ambulances were sent off, one after the other, to grope their way as they might to the corps to which they had been assigned, or to hunt up some special field of usefulness. Everything was done in the dark, and while the majority of the ambulances were wandering about the country, signal services were rendered only by the few which blundered into usefulness.

The chiefs of certain of these ambulances acknowledged the failure of the system in their published reports. According to M. Le Fort, of the First Ambulance, "the experiment which has been tried by the Society has proved a complete failure." M. Championnier, of the Fifth Ambulance, concluded with: "I might endeavor to show the improvements of various kinds of which the volunteer ambulance corps are susceptible. I shall not, however, go into these details, as I believe that civil ambulances, so far as battle fields are concerned, have played their rôle, and that rôle is finished." While M. Piotrowski, of the Sixth Ambulance, a member of the Council of the French Society, affirmed, as the result of his experience, that "the Sanitary service of the army should have an organization wholly military, and in no way civil, especially upon the battle field." Commenting on the history of the Society, Dr. Crane stated: "There can be no place in any well-regulated army

for a volunteer health service. It is as anomalous a creation as would be a volunteer ordnance department, or a volunteer commissariat; and not one of the least remarkable, I might say astounding, facts connected with the late war was the recognition of voluntary ambulance corps as constituent elements of active armies, and that, by a government presumed to be pre-eminently skilled not only in matters of military art, but in the general science of organization. The French Société de Secours aux Blessés completely mistook its own proper vocation. It misconceived, apparently willfully, the true province of voluntary effort in behalf of the sick and wounded of armies; and a new field, once opened to it, seemed even, at times, to be led on rather by an inordinate desire of securing to itself official and popular power, and the brilliant insignia of a new order of hospitalers, than by a desire to fulfill in the most effective manner the conscientious duties of charity and citizenship."

But, although it is not likely that the American Red Cross Association will be of material service on future battle fields, the history of the German Association, and of our own Sanitary Commission, shows that it may be of inestimable value in adding to the comfort of sick and wounded soldiers in hospitals, removed from the actual theater of war. Besides, under the "American Amendment" the Association has grand opportunities for administering national relief in times of pestilence, famine, flood, or other calamities.

The American people are generous when their sympathies are appealed to by suffering and disaster. The Red Cross Association has, therefore, never failed to receive prompt aid in emergencies. As soon as the announcement is made in the press dispatches that the Association is on the ground, and in need of help for those suffering from some great calamity, the required stores and supplies are forwarded from every quarter. It has gained the full confidence of the people. Money and supplies to the value of $500,000 were expended by its agents at the time of the Johnstown disaster in 1889. It has done equally efficient work in various parts of the country. In Michigan, during the forest fires of 1881; in South Carolina, after the earthquake of 1886, and the tidal wave of 1893; in Texas, during the drought of 1886; after cyclones in Mississippi and Illinois, and during the floods of the great river valleys.

In conclusion, your Committee desires to state that this report was submitted for the consideration and criticism of the American Branch of the International Red Cross Association. It was carefully considered by the Board of Directors; and a copy of the objections of the Board to this report, together with copies of the Articles of Incorporation, dated July 1, 1881, and of the Certificate of Incorporation, dated April 17, 1893, are hereto appended. (See appendix, following original articles.)

Leonard B. Almy,
Lieut.-Col. and Medical Director, C. N. G.

Charles W. Woodward,
Lieut.-Col., Surg.-Gen., Michigan (Retired).

Ch. Smart,
Major and Surgeon, U. S. A.

May 10, 1895.

Necrology.

In Memoriam.

MEDICAL-DIRECTOR JOHN MILLS BROWNE, U. S. N.

BORN MAY 10, 1831; DIED DECEMBER 7, 1894.

Medical-Director John Mills Browne was born in Hinsdale, New Hampshire, May 10, 1831; graduated at the medical department of Harvard University in March, 1852, and appointed assistant surgeon in the Navy of the United States, from New Hampshire, March 26, 1853.

His first duty was on board the U. S. Store-ship "Warren," Lieutenant-Commanding Fabius Stanley, at Saucelito, opposite San Francisco. The naval station at Mare Island was just then in contemplation, and Commander Farragut had been sent out, to get the plans under way, as the first commandant. He was obliged to live on board the "Warren" until some sort of quarters could be provided on shore. Dr. Browne was medical officer of this naval establishment until May, 1855, a characteristic and critical period in the settlement of California. Dr. Browne was next ordered to the U. S. Steamer "Active," which was engaged in the survey of the coast and harbors of California, Oregon, and Washington Territories, and in the Winter of 1855–56 (with the "Massachusetts" and "Decatur") in the Indian war in Puget Sound. In the Summer of 1857 the "Active" was engaged, with H. M. S. "Satellite," in settling the Northwest boundary.

After this long tour of duty on the western coast Dr. Browne came east, was promoted to Past-Assistant Surgeon, and ordered to the "Dolphin," of the Home Squadron, in June, 1858. She was commandéd by John N. Maffit, so well known afterward as the commander of the Confederate "Florida." In August, 1858, the

"Dolphin" captured the brig "Echo" off Cape Verde, Cuba, with over three hundred African slaves on board. The prize was sent to Charleston, South Carolina, and the negroes were taken to Liberia, on board the "Niagara."

When the Paraguay Expedition was sent out Dr. Browne was ordered to the U. S. Steamer "Atlanta," Capt. Daniel B. Ridgely, and detached before sailing. After short service at the U. S. Naval Hopital at Norfolk, he was attached to the U. S. Sloop-of-war "Constellation," flag-ship of the African Squadron, which we were at that time bound by convention to keep on the West Coast. During the cruise the "Constellation" captured, off the Congo River, the bark "Cora," with seven hundred and five slaves, who were sent to Liberia.

Dr. Browne was commissioned as surgeon June 19, 1861, and ordered to the U. S. Steam-sloop "Kearsarge," a ship which will always be celebrated in the annals of our Navy. She was sent on "Special duty" to the European waters in 1861, visiting all the ports of the British and continental littoral where she was likely to find the Confederate corsairs. At last, when in command of Commander Winslow, she found the "Alabama" in Cherbourg. The preparations for the engagement which became necessary were like those for a battle "in the lists," and when the hour sounded the champions came forth. The "Kearsarge" destroyed the "Alabama" in one hour and two minutes. Special trains came from Paris to witness the fight. The "Kearsarge" then went to Brazil to look for the "Florida," which was supposed to be about Fernando Noronha. Disappointed in the search, she returned to the United States.

After some temporary duty Dr. Browne was, in April, 1865, ordered back to the scene of his original duty in California, where he superintended the building of the U. S. Naval Hospital at Mare Island, and was in charge there for nearly ten years, with the exception of a cruise as Fleet-Surgeon of the Pacific Squadron. This latter post he again filled, after he had been made Medical Inspector in the regular course of promotion. He was commissioned Medical Director October 6, 1878, and then came east again. During 1880–82 he served as President of the Medical Examining Board at Washington, and was a member of the Board of Visitors to the U. S.

Naval Academy in 1881. In the same year he went to London, England, as the naval representative at the International Medical Congress; was a member of the National Board of Health in 1883, and in charge of the U. S. Naval Museum of Hygiene at Washington from 1882 to 1885. During that time he also served on the Board of Naval Regulations. In 1884 Medical-Director Browne was naval representative at the International Medical Congress at Copenhagen, and from 1885 to 1888 served as a member of the Naval Retiring Board. He became Chief of the Bureau of Medicine and Surgery, with the title of Surgeon-General of the Navy, April, 1888, and was retired in 1893, having reched the age of sixty-two years. Died 8.30 P. M., December 7, 1894, and interred with Masonic honors in the National Cemetery at Arlington, Virginia.

A. L. G.

In Memoriam.

BRIG.-GEN. CHARLES SUTHERLAND, U. S. A.

BORN MAY 29, 1829; DIED MAY 10, 1895.

GENERAL ORDERS, NO. 32.

HEADQUARTERS OF THE ARMY,
ADJUTANT-GENERAL'S OFFICE,
WASHINGTON, May 11, 1895.

The following order has been received from the War Department:

WAR DEPARTMENT,
WASHINGTON, May 11, 1895.

The Secretary of War announces to the Army the death of Brig.-Gen. Charles Sutherland, lately Surgeon-General of the Army, whose retirement from active service, after a long and honorable career, was announced in General Orders, No. 45, of 1893, from Headquarters of the Army.

Gen. Sutherland died at his residence in this city, at 11.45 P. M., on Friday, May 10, 1895.

As a special mark of respect to his memory, the officers of the Medical Department will wear the customary badge of mourning upon the left arm and upon the sword-hilt for the period of thirty days.

DANIEL S. LAMONT,
Secretary of War.

BY COMMAND OF LIEUT.-GEN. SCHOFIELD:

GEO. D. RUGGLES,
Adjutant-General.

The echoes of the cavalry trumpets, which, from the heights above Washington, had just sounded "taps," were scarcely silent when there passed from life's activities here to the life beyond one whose rule of action had always been devotion to duty.

Charles Sutherland, a scion of an old Pennsylvania family, was born in that State May 29, 1829, and received his degree in medicine from the Jefferson Medical College, Philadelphia, Pa., with the class of 1849. Imbued with a desire for military life, he applied for, and was granted, permission to be examined with view to an appointment in the Medical Corps, U. S. Army. The examination successfully passed, he was, on August 8, 1852, commissioned an Assistant Surgeon, with the rank of First Lieutenant, and assigned to duty in New Mexico, in which Territory and in Texas he remained until the outbreak of the War of Secession.

After a short service at Fort Pickens, Florida, in April, 1862, he was promoted to be Surgeon, with the rank of Major, and assigned to duty as Medical Director and Inspector of the Department of Tennessee, and later of the Department of Virginia and North Carolina; still later, he served as Medical Director of Hospitals.

At the close of that war he was brevetted Lieutenant-Colonel and Colonel for "meritorious service" and "diligent discharge of duty." In July, 1866, Col. Sutherland was appointed Assistant Medical Purveyor, with the rank of Lieutenant-Colonel, and in 1876 was promoted Colonel and assigned to duty as Medical Director, Division of the Pacific, where he remained until 1884, when he was ordered to duty as Medical Director, Division of the Atlantic, with station at Governor's Island, New York. Here he served consecutively on the staffs of Generals Hancock, Schofield and Howard, doing such excellent service then, and before, that in 1890 he was appointed Surgeon-General, with the rank of Brigadier-General, and remained in this office until, having reached the prescribed age, he was retired from active service, in compliance with the following order:

GENERAL ORDERS, No. 45.

HEADQUARTERS OF THE ARMY,
ADJUTANT-GENERAL'S OFFICE,
WASHINGTON, May 29, 1893.

The following order has been received from the War Department:

WAR DEPARTMENT,
WASHINGTON, May 29, 1893.

By direction of the President, the retirement from active service on this date, by operation of law, of Brig.-Gen. Charles Sutherland, Surgeon-General of the Army, under the provisions of the act of June 30, 1882, is announced.

Commissioned in 1852, Gen. Sutherland has passed successively through all the grades in his department, and, for a period of over forty years, has discharged with ability the functions of the several positions held by him, from Assistant Surgeon to Surgeon-General.

During the late war he served at the bombardment of Fort Pickens, Florida, and assault on Wilson's Camp, on Santa Rosa Island, and with the Army of the Tennessee in the campaign, siege, and surrender of Vicksburg. For war service he received the brevets of Lieutenent-Colonel and Colonel.

The valuable services rendered by him during his long career as an officer, and his worth as a man, assure for him, in the future, the honor and appreciation to which he is entitled. L. A. GRANT,

Acting Secretary of War.

Gen. Sutherland will repair to his home. The travel enjoined is necessary for the public service.

BY COMMAND OF MAJOR-GENERAL SCHOFIELD:

R. WILLIAMS,

Adjutant-General.

OFFICIAL:

Assistant Adjutant-General.

Gen. Sutherland devoted himself particularly to perfecting the Hospital Corps, in which organization he took the greatest interest. In an address delivered before the section of Military Medicine and Surgery of the Pan-American Medical Congress, 1893, he said:

"Being impressed with the importance of thoroughly instructing the members of the Hospital Corps in all their duties, I established two schools, or companies, of instruction and training, at military posts west of the Missouri River, selecting two of the largest, viz.: Fort Riley, Kansas, and Fort D. A. Russell, Wyoming. * * * * The object of these schools is twofold — 1. Always to have at hand, for any emergency, a trained body of sanitary soldiers, accustomed to working together; 2. To build up a training school, through which all enlisted men of the Hospital Corps should pass."

The work then inaugurated continues to be successfully carried forward, and its institution will be a monument to its founder, *monumentum ære perennius*, by which, perhaps, more than by all else of the good work he did, will he be remembered.

Appreciating the great importance to the country of a proper organization of the Medical Department of the National Guard in order that, through it, some knowledge of military sanitation might be widely disseminated in the profession, he early manifested the greatest interest in the Association of Military Surgeons of the United

States. His annual report to the Secretary of War for the year ending June 30, 1892, contains the following:

"Much attention has been given by this office to the organizatiou of the medical department of the National Guard, and every opportunity has been embraced of assimilating their methods to those of the Medical Department of the Army, with a view to effective co-opertion in time of war. It is as needful for the care of the sick and wounded of a large army that its medical officers be trained by the same methods, as it is for the military success of the command that each of its component organizations shall have been drilled in the same system of military tactics.

"The reports of our medical officers who have been on duty at some of the encampments of State troops show wherein lie the defects of their medical organization. Mauy of the medical officers of the guard are earnest students of military sanitary work, and have given public expression to the defects of their system and the importance of remedying them.

"Two of these defects are radical: The absence of an organized medical staff in the service of the State, and the absence of a hospital corps for service under that staff. These require and should have legislative action for their remedy. Medical officers are appointed to regiments, without examination as to their fitness for military duty, on the recommendation of the commanding officer of the organization; but, if mustered into the United States service, they would be subject to detail for such duties as each was best capable of performing, irrespective of the military organization which carried them ou its rolls. State medical boards should, therefore, examine those recommended for position on the medical staff, and assignments should be made in accordance with expediency in time of peace, location entering chiefly as a factor, and with known ability, in view of auticipated responsibilities in time of war.

"Service under the regimeutal medical officers of the guard is performed by details from the companies. The disadvantages of this system are that men wholly unfitted for the duties may be detailed, and that others who are well qualified, by natural constitution and careful training, may be relieved from their special duties at any moment by changes in the stations of their commands. It is sometimes claimed that the excellent working of our Medical Department during the War of the Rebellion was effected under the system of regimeutal medical officers, with details of enlisted men for hospital duty; but the claim should rather be that our Medical Department achieved its noble record in spite of these drawbacks. Our field divisiou hospitals, that were ever ready to pick up an exhausted soldier on the march, or to receive hundreds of gravely wounded men from the line of battle, were organized by treating the regimental medical officers as staff officers, subject to the orders of Medical Directors, and irrespective of State or regimeutal number; and the vital importance of the work done by these hospitals made permanent the details of the experieuced men who were on duty with them.

"In fact, the medical work of the War of the Rebellion, which at first, under the regimental system, was such as to cry aloud to the country for help to the suffering wounded, and to bring into existence the Sanitary and Christian commissions, and many State aid societies become, after the development of the division field hospital system, a very model for the armies of the civilized world. This success was achieved, it may be said, under fire on the battle field; and to accomplish it the medical and hospital systems now in use in the National Guard of the various States had practically to be broken up in favor of a medical staff with a specially trained corps of hospital and ambulance men, such as the Army has now been provided with by Congress. So earnest are many of the medical officers of the National Guard, that they have recently organized an Association of Military Surgeons for co-operation in making the Medical Department of the military forces of each State thoroughly fitted to take its place in the field, either by itself or as a component of a National Medical Department. The second annual meeting of this Association was held in St. Louis, Mo., in April last. Speaking of the co-operation of this office with the purposes of the Association, the President, Surgeon-General Nicholas Senn, N. G. Ills., remarked in his opening address: 'The general Government has encouraged us from the very beginning, by detailing for our benefit a number of the oldest and most experienced surgeons to attend our meetings. We have eagerly availed ourselves of their wise counsel in planning the sphere of our work, and will look to them in the future for instruction in the practical details of our duties as military surgeons.'

"*The Association shall assuredly have all the support which this office has the power to render.*"

Gen. Sutherland was in his domestic life a devoted and kind husband and father, endowed with the love of home, which comes to one "who has led a strong and active life in the combats and struggles of the world." He was a faithful friend, a skillful and beloved physician, and a loyal soldier. Truly may it be said he deserved well of his country. J. V. R. H.

In Memoriam.

LIEUT.-COL. CHARLES HAYES.

BORN MARCH 7, 1840; DIED JUNE 8, 1894.

Lieut.-Col. Charles Hayes, Medical Director of the Brigade, Rhode Island Militia, died suddenly June 8, 1894, at his home, Providence, R. I. He was the fifth child of Elijah and Jane Hayes, and was born in North Berwick, York County, Me., March 7, 1840. He was educated in his native town and at Phillips Academy, Exeter, N. H. Because of an accident to his leg, received in his youth, he was unable to enlist when the Rebellion broke out, but in 1862 he joined the corps of nurses, and was appointed Acting Assistant Surgeon. He served until his health became so impaired that he was compelled to withdraw from service. In 1864 he received his diploma from Dartmouth College, and again, in 1865, he resumed his hospital work at the front. In 1869 Dr. Hayes commenced practice in Fall River, Mass., but afterward removed to the West. In 1876 he moved from Ashland, Wis., and commenced practice in this city.

Dr. Hayes was a member of the Rhode Island Homeopathic Society, and served as Secretary for five years from 1883, and as President from 1888 to 1890. He was admitted to the American Institute in 1889. He was also a member of the Union Congregational Church. In 1877 Dr. Hayes was appointed Surgeon of the Providence Horse Guards, and in the following year received from the Governor his commission as Surgeon of the 1st Battalion of Cavalry, R. I. M., with rank as Captain, which was raised in 1888 to that of Major. In 1889 he was Acting Medical Director, Brigade R. I. M., while his chief was in Europe, and in 1892 he was appointed

to the position of Medical Director, with rank of Lieutenant-Colonel. Dr. Hayes was also a member of the Soldiers' and Sailors' Historical Society, of the Military Service Institution, and the Association of Military Surgeons of the United States. Socially, Dr. Hayes was a great favorite. He was kind of disposition and genial of manner.

He leaves a wife and three children, two girls and a boy.

JOHN. C. BUDLONG.

In Memoriam.

MAJOR-GEN. JOSIAH PORTER.

BORN JUNE 28, 1830; DIED DECEMBER 24, 1894.

Major-Gen. Josiah Porter was born in Cambridge, Mass, on June 28, 1830. He graduated from Harvard Collge in 1852, after which he studied law and was admitted to the bar. During the war he served as Captain of the 1st Massachusetts Battery, having previously been a member of the Boston Cadets, of the Boston City Guard, and Adjutant of the Ancient and Honorable Artillery. At the close of the war he resumed practice of the law in New York City. He joined the 22d Regiment, N. G. N. Y., as Captain of Company G, June 13, 1865; was promoted Major, May 10, 1867, Lieutenant-Colonel, January 30, 1869; Colonel, October 11, 1869, and remained in command of the 22d until he was appointed Adjutant-General of the State of New York by Gov. Hill in 1886; he was re-appointed by Gov. Hill in 1889, and again by Gov. Flower in 1892. His death occurred very suddenly on December 14, 1894, at his home in New York City. His funeral was a military one, and he was buried at Mt Auburn Cemetery, near Cambridge, Mass. A wife and two daughters survive him.

During his entire life Gen. Porter took the greatest interest in military affairs. He was a man of few words, sound judgment, and of marked executive ability. As an organizer his record gives ample proof. During the Civil War Capt. Porter's Light Battery was known as one of the best in the Army of the Potomac.

In later life the high standard of efficiency to which he raised the 22d Regiment, N. G. N. Y., as its Colonel, and later, that of the

entire National Guard of the State of New York, as Adjutant-General, are but further proofs of his powers in this direction.

And although he has answered the last roll-call and reported to the Supreme Commander, yet the influences of his counsel will long remain as a guiding star to the National Guard of the State of New York.

MAJOR BENNETT S. BEACH, M. D.
Surgeon, 22d Regiment, N. G. N. Y.

In Memoriam.

LEON ABBETT.

BORN OCTOBER 8, 1836; DIED DECEMBER 4, 1894.

Leon Abbett was born in Philadelphia, Pa., October 8, 1836. In 1853 he graduated from the High School of that city. After graduation he entered the law office of Hon. John W. Ashmead, and after attaining his majority began the practice of law.

In 1862 he removed to Hoboken, N. J., and entered into a law partnership with Wm. J. A. Fuller, of New York City, which partnership lasted thirty years, until Mr. Fuller's death. Mr. Abbett practiced law both in New York City and Hoboken, and subsequently in Jersey City. In 1863 he was appointed Corporation Attorney of Hoboken. In 1864, and again in 1865, he was elected to the State Legislature, House of Assembly. In 1868, having removed to Jersey City, he was again elected to the House of Assembly, and in 1869, having been re-elected, he was chosen Speaker of the House. In 1874 he was elected as a State Senator, from Hudson County, and in 1877 was chosen President of the Senate. He served as Corporation Counsel of Jersey City from 1876 to 1883, in which latter year he was elected to the office of Governor of New Jersey. In 1889 he was re-elected Governor. He was a delegate to the National Democratic Conventions in 1872, 1876, 1884, 1888, and 1892. At the latter convention Gov. Abbett was selected to nominate Grover Cleveland for President. In 1893 Gov. Abbett was appointed as an Associate Justice of the Supreme Court of New Jersey. He died while an incumbent of that office, December 4, 1894.

In the Winter of 1892, while Governor of the State, a determined effort was made by Gen. J. W. McGill, Surgeon-General of New

Jersey, to secure for the medical staff autonomy, organize a medical departmeut, and recruit a hospital corps. These sweeping innovations had been bitterly opposed by all line officers and the State Military Board. With the exception of a few medical officers, the Surgeon-General was left alone to fight the unequal battle. An act was introduced in the Legislature to secure to the medical staff the reforms demanded, and, after a bitter struggle, the act was passed, and signed by the Governor, who espoused heartily the cause of the medical officers, and assisted the Surgeon-General in his contest. Without his powerful aid, medical autonomy might yet, in the National Guard of New Jersey, be only a possibility of the future.

Original Papers.

CONSERVATIVE SURGERY ON THE BATTLE-FIELD AND FIRST AID TO THE WOUNDED.

By N. SENN, M. D., PH. D., LL. D.,
Colonel and Surgeon-General of the Illinois National Guard, Chicago, Ills.; President of Association of Military Surgeons of Illinois; Ex-President Association of Military Surgeons of the United States.

Conservatism will characterize the military surgery of the future. The two great sources of danger that face the wounded soldier upon the battle field—hemorrhage and infection—will be greatly diminished by additional and improved hemostatic measures, and the more general and effective application of the principles of aseptic and antiseptic surgery. Mutilating primary operations will be limited to injuries with extensive destruction of the soft parts and complications involving large vessels and nerves, which, in themselves, are sufficient to arrest the nutrition of the injured limb. Gunshot injuries of bones and joints will no longer determine the propriety of primary resection and amputation, and the danger of penetrating wounds of any of the large cavities of the body will be greatly diminished by the prompt employment of measures calculated to prevent septic infection, and other immediate and remote complications. I take it for granted that I am expected on this occasion to discuss briefly the salient topics which will engage the attention of the military surgeons of future wars, and which will enable them to reduce the death rate, diminish suffering, save limbs, and prevent painful remote complications in case of bullet and other wounds which heretofore demanded primary mutilating operations; or, if treated upon conservative plans, subjected the soldier to imminent danger to life from septic complications.

Conservative surgery on the battle-field consists in rendering prompt and efficient aid to the wounded. To accomplish this successfully is the desire and aim of the military surgeons of all civilized nations. A well-trained hospital corps is now looked upon as

an essential constituent of every modern military body. In our own country the Army and Navy, as well as the National Guards of the different States, are making ample preparations for effective first aid to the wounded, in the event of war, by the careful training of soldiers selected for hospital corps service. The practice of conservative surgery upon the battle-field will, of necessity, be intrusted largely to the educated, well-trained, non-combatant soldier. It is the character and efficiency of his work that will determine the fate of the wounded. I shall limit my remarks to the discussion on the work to be done by the surgeon and his helpmates, the members of the hospital corps, in caring for the wounded upon the battle-field, which will embrace: 1. The treatment of hemorrhage; 2. To counteract shock; 3. Primary dressing; 4. Immobilization; 5. Transportation.

Temporary Hemostasis.—A large percentage of deaths upon the battle-field has been caused by the immediate result of hemorrhage. It is to be expected that the small-caliber bullet, owing to its greater velocity and penetrating power, will cause death more frequently from primary acute hemorrhage than the round or large conical bullet of the past, because the wounds inflicted by it resemble more nearly incised than contused wounds, as was formerly the case. There can be but little doubt that the old weapon produced wounds which were more liable to be followed by secondary hemorrhage, induced by the sloughing of the large area of contused tissue surrounding the tubular wound made by the bullet. The absence of this extensive area of contusion and laceration in wounds of large blood vessels made by the new bullet will increase the danger from primary hemorrhage, and will consequently demand, more frequently and urgently in their treatment, the employment of prompt and efficient hemostatic measures. The treatment of hemorrhage upon the battle-field will be governed by the size and character of the vessel wounded, and the part or organ injured. A distinction between arterial and venous hemorrhage is impracticable so far as the immediate treatment by non-professional assistants is concerned. Ligation of a blood vessel upon the battle-field, either at the point of injury or in its continuity, will be done only in exceptional cases. In the majority of instances this part of the treatment will be consigned to the surgeons in charge of the first dressing station or the field hospital. In rendering the first aid to the wounded,

FIG. 1. Elevation of the upper extremity in the treatment of hemorrhage.

FIG. 2. Gun-stack for elevation of the lower extremity.

hemorrhage should be diminished or arrested by such means and measures as are always at hand, or that can be readily extemporized and can be safely and efficiently applied by members of the hospital corps.

Elevation of Limb.—The force of gravitation answers an exceedingly useful purpose in arresting hemorrhage from the smaller vessels of the extremities. By placing the injured limb in a vertical position, intravascular pressure is so much diminished that spontaneous arrest of hemorrhage is often effected by this simple procedure, even when a vessel the size of the palmar arches is injured, but its greatest value and widest range of application will be in the treatment of venous and parenchymatous hemorrhage. The elevated position should be maintained for some time after the hemorrhage has ceased, or until more efficient measures can be employed. The manner of effecting and maintaining elevation as a hemostatic agent is shown in Figs. 1 and 2.

Digital Compression.—In the treatment of hemorrhage from large vessels accessible to digital compression, this method offers a reliable means of controlling hemorrhage. The members of the hospital corps are familiarized with the exact location of the principal arteries of the extremities and the method of arresting hemorrhage by digital compression.

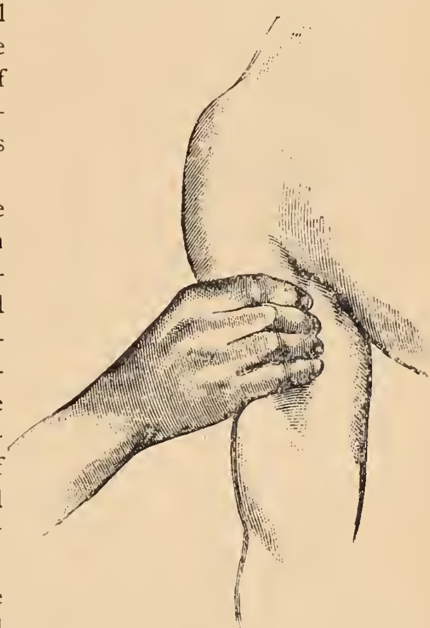


FIG. 3. Digital compression of brachial artery.

The compression must be continued uninterruptedly until the bleeding vessel can be tied, or pressure can be replaced by elastic constriction or the antiseptic tampon.

Flexion.—Forced flexion as an hemostatic agent was introduced by Adelmann. Genuflexion is a prompt and efficient method of

arresting hemorrhage from the popliteal artery and its branches. Brachial hyperflexion answers the same purpose in the treatment of hemorrhage from the brachial artery from a point opposite the elbow joint, or any of its branches below this point.

In making genuflexion the belt, suspender, gun strap, or triangular bandage should be passed through a slit in the shoe or boot above the heel, after which the ends are firmly tied over the base of the thigh, where it is fastened to the pants or drawers with a safety pin. Forced flexion of the forearm can be made with an ordinary handkerchief.

Elastic Constriction.—Elastic constriction, properly applied, is a safe and absolutely reliable hemostatic agent in preventing and controlling hemorrhage from any of the vessels of the extremities. Introduced and popularized by the greatest military surgeon of the present time, Von Esmarch, it is applied wherever surgery is practiced, but its employment is of special value upon the battle-field. The elastic constrictor has displaced almost entirely the ordinary tourniquet. Preliminary compression of the limb by an elastic bandage is unnecessary, as simple elevation, continued for a few moments, will render the limb sufficiently bloodless for all practical purposes. The harmful effects of elastic constriction improperly applied are temporary, and even permanent, paralysis of one or more of the principal nerves injured by the linear compression. To prevent such a complication it is necessary to compress the limb at a point where the main nerves are adequately protected by muscles, and to bring to bear no more pressure than is necessary to realize the object for which the constriction is made—to interrupt, completely, both the venous and arterial circulation. The arm should be constricted at a point corresponding with the middle of the deltoid muscle, or over the top of the shoulder, and the thigh near its base.

To avoid harmful linear constriction it is advisable to use an elastic band at least an inch in width, or a suspender, and if the constrictor encircles the limb more than once, to bring each turn separately down upon the surface of the limb, and not overlap each other. An assistant should hold the limb firmly, in a vertical position, when the constrictor is applied over the side of the limb where the large blood vessels are located, and the constriction quickly and

firmly made, so as to interrupt at once, completely, both the arterial and venous circulation. How long is it safe to exclude from a limb the circulation by elastic constriction? This is an important question which presents itself with special force in the practice of military surgery. I made, a few years ago, an interesting series of experiments on dogs for the purpose of formulating an authoritative answer to this question. Elastic constriction was applied by using rubber tubes the size of an ordinary lead pencil, and the constriction was continued from one to twenty-six hours. Temporary paralysis was observed in a number of cases. Gangrene of the limb below the point of constriction resulted only in one case, and in this instance the constriction was continued for twenty-four hours, while the dog in which the constriction was continued for twenty-six hours recovered in a short time perfect use of the limb. The blood contained in the arteries and veins below the point of constriction remained fluid and retained its intrinsic functional properties for this length of time after complete exclusion from the general circulation. Elastic constriction is not attended by any special danger from this source. Every surgeon has had cases in which elastic constriction was continued for several hours, in the performance of difficult and tedious operations, without witnessing any untoward, immediate or remote results from the prolonged interruption of the circulation. I have learned of a number of cases of railway injuries in which elastic constriction was continued from seven to twelve hours without any obvious harmful results. From the results of my own experiments, and the clinical data on elastic constriction as a hemostatic resource, I am satisfied that it is safe to exclude the

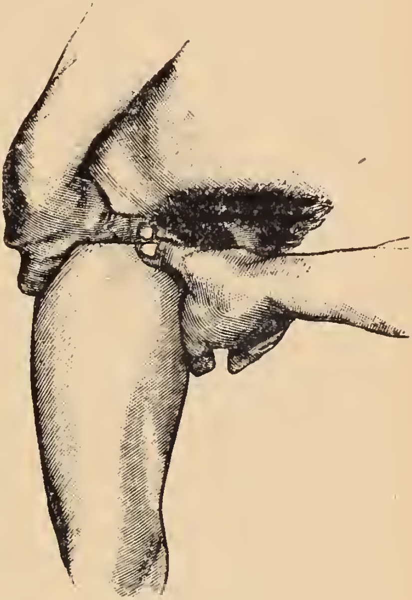


FIG. 4. Digital compression of femoral artery.

circulation from a limb for four to six hours without incurring any special risks of gangrene or permanent damage to large nerve trunks. The exact limit of prolonged constriction in man has not been determined, and I should consider it unwise to continue it beyond the time specified. In the majority of cases, during this time, the wounded will be brought to the attention of surgeons, when the injured vessel is exposed and tied, or elastic constriction is replaced by direct compression.

Antiseptic Tampon.—The antiseptic tampon is a convenient and very useful hemostatic agent in the treatment of accidental hemorrhage. The antiseptic package, with which every soldier of civilized warfare will be supplied, can be used advantageously for this purpose. It will prove of special value in the arrest of hemorrhage from the vessels of the scalp, face, and intercostal arteries, and in the treatment of open, lacerated, and saber wounds. The surface to be compressed should be dusted with the antiseptic powder contained in the package, and with the hygroscopic antiseptic material composing the balance of the package a graduated compress is made, the apex of which is placed in contact with the bleeding vessel, and the necessary degree of pressure secured by a circular bandage, with or without the use of an extemporized splint, according to the location of the vessel, or the relations of the injured vessel to the underlying bone.

Vessel injuries treated by antiseptic tamponade will seldom require ligation, as the tampon, if the wound remains aseptic, is allowed to remain until the lumen of the vessel has become obliterated permanently by thrombosis and cicatrization.

Internal Hemorrhage.—The prompt and proper treatment of internal hemorrhage will constitute one of the crowning triumphs of surgery upon the battle-field. The direct treatment of the injured vessels by early invasion of any of the three large cavities of the body will be the means of saving many lives which heretofore were doomed to certain death. This part of the surgeon's work will be done at the first dressing station, or the field hospital.

What can be done behind the fighting line in such cases to bridge over the time until such services can be rendered to the injured? In hemorrhage from the intracranial vessels, caused by bullet wounds, it would be dangerous to plug the wounds of entrance and

FIG. 5. Genuflexion in the treatment of hemorrhage from the popliteal artery and its branches.

FIG. 6. Forced flexion of forearm in arresting hemorrhage from the brachial artery opposite the elbow joint or any of its branches below this point.

exit, as the accumulation of blood in the cranial cavity would result in death from cerebral compression. The escape of blood should be favored by inserting into the track made by the bullet a strip of aseptic or iodoform gauze. This will not only serve a useful purpose as a capillary drain, but by bringing in contact with the injured vessels an aseptic foreign substance the spontaneous arrest of hemorrhage by thrombosis is favored. The gauze drain should be secured on the surface of the wound with a safety pin, and the wound or wounds protected against infection by an antiseptic dressing, retained in place by the triangular bandage. By this treatment many cases will reach the field hospital for a timely intracranial operation. In bullet and stab wounds of the chest, complicated by hemorrhage from the intercostal arteries, the antiseptic tampon is the proper treatment. Packing of the tubular wound with an antiseptic hygroscopic material will not only succeed in arresting the hemorrhage, but will serve at the same time as an efficient capillary drain and protect the cavity of the chest and its contents against infection. In hemorrhage from injuries of the organs of the chest, firm circular compression of the chest directly over the wound already protected against infection, by an antiseptic dressing, constitutes a valuable indirect hemostatic measure.

Immobilization of the chest wall by circular compression diminishes the functional activity of the lungs, and in doing so exerts a favorable influence in arresting hemorrhage from this organ. The cartridge belt or gun strap can be used to the greatest advantage in limiting the respiratory movements of the chest. I believe that this conservative treatment of penetrating wounds of the chest will yield better results than injection of filtered air, absorbable aseptic solutions, or treatment by rib resection, free incision, and attempts to ligate the bleeding vessels. In penetrating wounds of the abdomen the prime indication in the future treatment of such injuries will be to prevent death from hemorrhage. Visceral wounds of the abdominal organs, notably the liver, spleen, and mesentery, usually give rise to profuse, and often fatal, hemorrhage. The hemorrhage is more frequently venous and parenchymatous than arterial. In my address last year before this Association, I urged the importance of early operative interference in such cases, and mentioned hemorrhage and the direct treatment of vis-

ceral wounds as ample indications to justify prompt, active interference. In injuries of vessels below the bifurcation of the abdominal aorta, attempts should be made to prevent death from hemorrhage upon the battle-field by resorting to the use of some sort of compression, with a view to interrupting the circulation in the aorta above the bleeding point. Esmarch's method, shown in Fig. 11, can be extemporized in a few moments, as it requires no instrument of special construction and meets the indications more completely than the various instruments devised for this purpose.

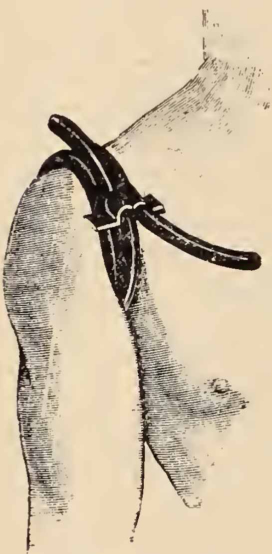


FIG. 7. Elastic constriction of upper extremity. (After Seydel.)

The method of Brandis is equally simple and efficacious. As hemorrhage from any of the vascular organs and large vessels of the abdominal organs requires prompt treatment, and as in large engagements a considerable length of time will necessarily intervene between the first aid and the permanent arrest of hemorrhage by laparotomy, and as in many instances the location of the wound is outside of the range of successful treatment by compression of the abdominal aorta, it appears to me that in such cases it would be good treatment to resort to direct and circular compression, as has been described in connection with penetrating wounds of the chest. The wound of entrance and exit, if the latter exists, should be protected by an antiseptic dressing. Over the wound, corresponding with the yielding part of the abdominal wall, a large compress, which may be composed of a compress made of a blanket, an article of clothing, a cartridge belt, or canteen, should be placed, and over it firm circular compression made with a belt or gun strap. The direct compression made in the direction of the track of the bullet will do much toward diminishing the vascularity of the underlying injured parts, while the circular compression will immobilize the abdominal wall at the seat of injury and limit the movements of abdominal organs, conditions which can not fail in materially diminishing the risks of hemorrhage and in aiding thrombosis, nature's resource, in effecting spontaneous arrest of hemorrhage.

FIG. 7a. Suspender constriction of arm.

FIG. 8a. Elastic constriction of thigh.

PERMANENT HEMOSTASIS.—*Forcipressure.*—The best and most successful military surgeon is the one who accomplishes the most with the least number of instruments. Complicated instrument cases look well and make a favorable impression upon laymen, and can be used to advantage in a well-equipped hospital; they are out of place on the battle field. The fewer the instruments in the treatment of emergency cases, the less the danger of infection. The writer has recently devised an operating pocket case, which con-

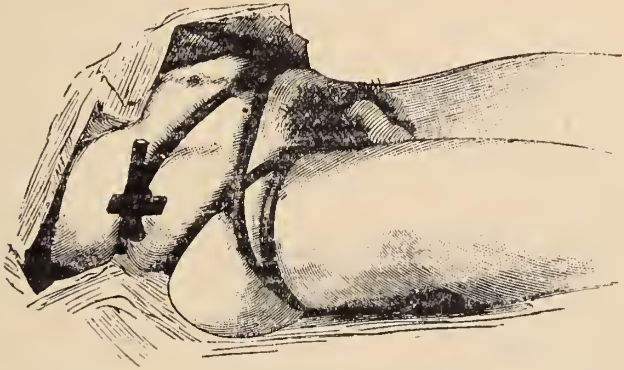


FIG. 8. Elastic constriction of the lower extremity. (After Seydel.)

tains all the instruments a military surgeon is expected to use when in active service. It contains, among the instruments needed for emergency work, seven hemostatic forceps, by the use of which he is in a position to meet the emergencies incident to hemorrhage upon the battle-field. The use of aseptic hemostatic forceps upon the battle-field will meet the indications successfully in many cases in which other hemostatic measures are inapplicable. If the bleeding vessel is so located that it can be grasped with hemostatic forceps, but can not be ligated without performing a formidable operation, the forceps should be allowed to remain and should be incorporated in the antiseptic dressing, and a note made to this effect on the diagnosis tag.

Ligature.—Ligation of blood vessels, arteries, and veins will usually be done upon the battle-field after temporary hemostasis by other means, either at the first dressing station or, more frequently, at the field hospital. Silk is the proper ligature material in military

service. Silk can be sterilized repeatedly by boiling, and is, consequently, a much safer material than catgut in emergency practice. Aseptic silk in an aseptic wound invariably becomes encysted. Catgut sterilized in Boeckmann's sterilizer, and kept ready for use in sterilized envelopes, as advised by Boeckmann, could be made serviceable for military surgery. As a rule, the vessel should be tied at the seat of injury by enlarging the existing wound and using it as a guide to the injured vessel. Cases, however, will present themselves in which it is impossible to apply this rule, and where the artery has to be tied in its continuity in a more accessible place on the proximal side of the bleeding point. Antiseptic precautions in the treatment of wounds and the employment of the aseptic ligature will materially diminish, if not entirely overcome, the risk of secondary hemorrhage, which proved such a terror to the surgeons, and such a frequent source of danger and death to the injured, during the great War of the Rebellion. The ligature should never be tied sufficiently tight to rupture any of the tunics of the vessel. All that is necessary to obtain an ideal permanent obliteration of the vessel is to approximate and hold in uninterrupted contact the intima. If the vessel requiring ligature in its continuity is a large one, a double ligature with a bloodless space between the two ligatures is preferable, as the space interposed between them offers the most favorable conditions for an early and permanent obliteration of the lumen of the vessel. Under aseptic and antiseptic precautions the ligation of large veins is as safe a procedure as ligation of the accompanying arteries.

Vein Suture and Lateral Ligature.—In small wounds of large veins, lateral ligature and suturing with fine silk or catgut secures permanent hemostasis with preservation of the lumen of the vein, and for these reasons should receive in this kind of vein injuries the preference to ligation in continuity. This method of treatment receives particular value in the case of wounds of the superior longitudinal sinus and the large veins at the base of the neck in the axillæ and the groins, as well as the large veins in the abdominal cavity. The lateral ligature is applied by seizing the margins of the vein wound with a sharp tenaculum and tying the base of the cone with a fine silk or catgut ligature. In suturing of vein wounds the margins are inverted toward the lumen of the vessel in the same manner as in closing an intestinal wound by Lembert's sutures.

Fig. 9. Antiseptic tamponade of wound of deep palmar arch.

Fig. 10. Treatment of penetrating wound of chest by antiseptic tamponade and immobilization by circular compression.

Hot Water and Styptics.—Hot water, at a temperature of 120 to 130 degrees F., coagulates the albumin upon the surface of the wound, and in doing so seals the orifices of small vessels, and on this account has become a popular hemostatic in arresting parenchymatous bleeding in parts and organs accessible to this method of treatment. The employment of styptics in arresting hemorrhage, on the whole, should be discountenanced, as their use interferes with an ideal healing of the wound, Their application can only come in question in the treatment of bleeding wounds of the mouth and pharnyx, where antiseptic tamponade is impracticable.

Saline Infusion.—Patients who have become debilitated by hemorrhage to the extent of endangering life, require restoration of a normal degree of intracardiac and intravascular pressure by saline infusion. Transfusion of blood, whole or defibrinated, has been proved clinically and experimentally a failure in preventing death from the immediate and remote results of dangerous hemorrhage. The transfused morphologic elements of the blood do not retain their vitality, and are destined to be removed from the receiver, sooner or later, by elimination through some of the excretory organs. Von Bergmann and others have shown that the immediate cause of death from acute hemorrhage, subnormal intracardiac and intravascular pressure, can be avoided more successfully by substituting for animal or human blood a physiologic solution of common salt.

Every field outfit should be supplied with a definite quantity of salt, from which the solution can be prepared in a few moments when required. Szumann's solution is the one usually preferred. It consists of:

Natr. chlorat	6.0
Natr. carbon	1.0
Aq. distillat	1000.0

The chloride and carbonate of soda in the above proportion should be carried in every pannier, so as to be available in all cases in which a saline infusion may become necessary. The simplest apparatus for making a saline transfusion is a glass or hard rubber funnel, with two or more feet of rubber tubing, and a small glass tube with a tapering point. The median basilic vein is usually selected for making the injection. The vein is exposed by a small

incision, after having rendered it turgid by proximal compression in the same manner as in performing phlebotomy. After exposure of the vein it is incised transversely, and the point of the glass tube is inserted and fastened in place by a ligature previously inserted. Before inserting the glass tube the precaution is taken to fill it and the rubber tube with the saline solution, to prevent the introduction of air. The saline solution to be used should be heated to the temperature of the body, and infection is prevented by using only sterilized water for the solution.

The quantity of solution to be used to fulfill the therapeutic indications will vary from 500 to 1,500 grams, 1,000 grams being a fair average dose, and for the preparation of which the necessary quantity of powder should be kept in readiness. If the symptoms of improvement which follow the employment of a saline infusion should come to a standstill or disappear, it may become necessary to repeat the intravenous injection in the course of an hour or more. The same object gained by intravenous injections of salt solution is attained more indirectly, and with greater loss of time, by copious hypodermatic and rectal injections.

Autotransfusion.—In threatening danger to life from hemorrhage much can be gained from autotransfusion. The exclusion from the general circulation of unessential parts of the body will often secure for the vital organs an adequate blood supply. Autotransfusion for this purpose is secured promptly and efficiently by elastic constriction of one or more extremities at their base. This can be accomplished by Esmarch's constrictor, suspenders, or, in the absence of elastic material, by the use of the Spanish windlass. According to the urgency of the symptons presented, the base of one or more extremities is constricted after rendering the limb comparatively bloodless by elevation. By exclusion of the circulation from one or more extremities, intravascular pressure compatible with essential functions is restored and life is bridged over for a sufficient length of time for the employment of remedies of more lasting value.

Shock.—Next to hemorrhage, shock should receive the surgeon's attention. It is often difficult to differentiate between the symptoms produced by shock and hemorrhage. The non-professional assistant should be made to understand that the maximum symptoms of shock are developed almost immediately after the receipt of the in-

FIG. 11. Compression of abdominal aorta. (After Esmarch.

FIG. 13.

jury, while in hemorrhage the intensity of the symptoms increases progressively. Even in a complete transverse tear of an artery the size of the common carotid, it requires at least five minutes to produce death from hemorrhage; in intense shock, symptoms pointing to a fatal issue appear almost immediately upon the receipt of injury. Shock is the result of a reflex vasomotor paresis, and, consequently, if severe, calls for the most energetic and prompt treatment. A patient suffering from shock should be kept in the dorsal recumbent position and treated by active stimulation. Inhalations of nitrite of amyl and hypodermatic injections of strychnia, in doses of from one-fifteenth to one-twentieth of a grain, repeated every half hour until reaction takes place, constitute the most successful treatment. The administration of alcoholic stimulants, camphor,

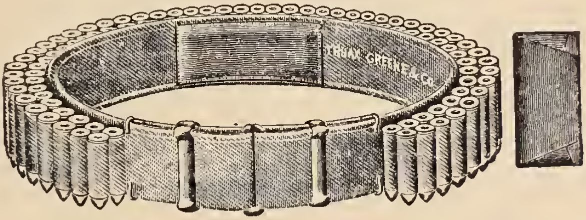


FIG. 12. Cartridge belt with package sewn on inner surface.

and ammonia is also indicated, as well as the external application of dry heat. In the transportation of patients suffering from shock the greatest care should be exercised not to subject them to any unnecessary movements, and it is of special importance that the recumbent position should be maintained until reaction is established. No operation of any considerable importance should be performed until the patient reacts from the immediate effects of the injury.

Primary Dressing of Wound.—Perfect aseptic surgery upon the battle-field is a happy dream which will probably never be realized. The bullets, as recent experiments have shown, are frequently contaminated with pathogenic microbes, and often carry with them infectious fragments of clothing and other foreign substances, as well as microbes from the surface of the injured part. Again, in large battles the number of wounded is so great and the number of those to whom their treatment is intrusted so small, that the neces-

sary antiseptic precautions to obtain an antiseptic condition of the wound can not always be carried out. The duty of the surgeon upon the battle-field, in rendering the first aid to the wounded, after having given proper attention to the treatment of shock and hemostasis, will be to prevent subsequent contamination of the wound, by protecting it with an antiseptic occlusion dressing. Shaving and disinfection of the surface in the vicinity of the wound will be out of the question under such circumstances. Search for bullets and efforts to secure their removal must be postponed until the patient reaches the field hospital, where these procedures are facilitated and the attending danger of causing infection diminished by a more complete instrumentarium and more efficient means to secure asepticity of the wound and its vicinity.

Behind the fighting line, and at the first dressing station, the primary dressing of the wound should consist of the antiseptic package which every soldier should carry with him. The best place where this package should be kept has not been determined. Esmarch suggests that it should be sewed in some part of the uniform. It appears to me that no part of the clothing of the soldier would be a sufficiently safe place for this most important outfit when in active service. In the heat of battle the soldier often relieves himself of a part of his clothing, his knapsack; but there are two things which he will not part with willingly, and these are the cartridge belt and gun. It appears to me that this package could always be found upon the wounded soldier if it were sewed upon the inner surface of the cartridge belt. The package should be thin, and correspond in width with the cartridge belt. Esmarch's package used in the German Army contains one triangular bandage, one safety-pin, two compresses of salt sublimate mull 10 cm. wide and 100 cm. long, each wrapped in impermeable paper, one salt sublimate cambric bandage 10 ctm. broad and 2 m. long. All these articles are wrapped in gutta-percha paper. This package is too cumbersome, and contains articles which can be dispensed with in the dressing of wounds upon the battle-field. In the majority of cases the first dressing is only a temporary one and is replaced later when the wound is subjected to thorough examination and treatment by a more efficient one. The package should be as small and compact as possible, and should contain only such articles as are absolutely necessary to pro-

FIG. 14.

FIGS. 13, 14, 15. Showing primary dressings of the head, upper and lower extremities.

FIG. 16. Immobilization of arm and forearm by fastening the sleeve to the coat near the wrist and elbow joints with safety pins and inserting the hand underneath coat on opposite side between two buttons.

FIG. 17. Mitella by fastening lapel of coat on injured side with two safety pins in such a position as to support the forearm in a flexed position.

tect the wound against infection during the interval between the receipt of the injury and the arrival of the patient at the field hospital. Cotton is the most compressible hygroscopic dressing material and the most efficient filter in preventing the access of microbes to the wound. Two drachms, or half an ounce. of compressed salicylated cotton will furnish the necessary material for a primary occlusion dressing. This can be held in place in almost any part of the body by a triangular gauze bandage, assisted, if circumstances make it necessary, by the cartridge belt, gunstrap, or articles of the patient's clothing. A safe and efficient antiseptic powder, which does not easily deteriorate, should invariably constitute a part of the package. A combination of boric and salicylic acid is the one I should propose for this purpose. Two grams of boric acid and half a gram salicylic acid, thoroughly triturated, should be incorporated in the center of the compressed cotton, the cotton surrounded by the triangular gauze bandage, and, with the addition of a safety-pin, wrapped in gutta-percha tissue.

In applying the dressing the compressed cotton is loosened, the wound freely dusted with the powder contained in the center of the package, the wound well covered with the cotton, which should overlap its margins, and the dressing held in place by the triangular bandage, and such additional extemporized means of retention as may be necessary.

For the purpose of preventing rapid decomposition of the blood, which will soon saturate the primary dressing, and with a view of guarding against infection of the wound from this source, it is absolutely necessary to incorporate with the dressing material and bring in contact with the wound a safe and efficient antiseptic, which, in this package, consists of a combination of boric and salicylic acid.

Immobilization of Injured Joints and Fractured Limbs.— In the case of fractures and joint injuries, the affected limb should be properly immobilized to prevent additional injury and pain during the transportation of the patient to the field hospital. As it is impossible for the surgeons and Hospital Corps to carry with them upon the battle-field material for splints in sufficient quantity, they must depend upon articles which can always be found upon the battle-field, in securing for the limb a proper mechanical support. A few of such extemporaneous dressings will be shown in the following figures.

The splint should be well padded with the blanket, or articles of wearing apparel. In compound fractures and penetrating wounds of joints perfect immobilization by a plaster of paris splint should be secured as soon as possible, but as this can not be done behind the fighting line, for obvious reasons, the temporary improvised dressing should be replaced by the permanent fixation dressing at the field hospital. Antiseptic precautions and perfect immobilization will be the most important elements in the conservative treatment of compound fractures and penetrating injuries of large joints.

Transportation of Sick and Wounded.— Increased and improved facilities for rapid transportation of the wounded, from the fighting line to a place of safety, will be an essential requirement in securing the greatest amount of benefit from conservative surgery upon future battle-fields. The general introduction of the new infantry weapon will make it necessary to establish the field hospital farther in the rear of the line of battle than formerly. Unless a natural protection by a hill or deep ravine is available, it will be necessary to locate the field hospital at least 3,000 meters from the line of action. This will necessitate an improved ambulance service. The latter will be resorted to in transporting the severely wounded from the point where the first aid is rendered to the first dressing station.

A well-trained hospital corps, and the use of improved litters and ambulances, will be instrumental in securing prompt and easy conveyance of the wounded from the line of duty to their destination. An efficient bicycle litter is a much-needed desideratum in the transportation of the wounded from the fighting line to the first dressing station and field hospital.

The Surgeon's Work at the Field Hospital.—The conservative work begun on the battle field is continued at the field hospital, which offers additional facilities for the practice of ideal conservative surgery. It is here that efficient measures can be employed to correct the injurious effects of profuse hemorrhage and to overcome the symptoms of prolonged shock. It is here that every serious wound will be thoroughly examined, and, under strict antiseptic precautions, will be subjected to the necessary treatment. It is here where permanent hemostasis will be substituted for temporary measures. It is here that the abdomen and cranial cavities will be opened for penetrating wounds requiring such intervention for the arrest of

hemorrhage, the removal of foreign infected bodies, and the direct treatment of visceral wounds. It is here that permanent plaster of paris splints will be substituted for the temporary fixation dressings, in cases of compound fractures and penetrating wounds of joints.

Indications for Probing and Extraction of Bullet.—The modern small-caliber bullet will render a resort to the bullet probe much less frequent than was the case in the wars of the past. Owing to its greater velocity and power of penetration, it will pass through the different parts of the body, regardless of the resistance offered by the osseous structures at a distance intended for shooting to kill. In the presence of a wound of entrance and exit the use of the probe should be dispensed with, as an exploration of this kind would yield no indications of diagnostic value, and might become a source of infection or a cause of renewal of hemorrhage. The jacketed bullet is less liable to undergo deformation in striking a hard object, such as bone, and is also less likely to become deflected than the leaden bullet. Additional modifications of the character of the bullet wounds will render the use of the probe less frequent in the future than in the past. Search for the bullet under antiseptic precautions is justifiable in gunshot fractures, penetrating wounds of the cranium, and joints. It is absolutely contra-indicated in penetrating wounds of the chest and abdomen. In bullet wounds of the soft parts, an attempt in this direction is warranted when the surgeon has reason to believe that the bullet is located in a place accessible to its safe removal. Probing for bullets, on the whole, has done more harm than good in the past, and the limits of the indications for this procedure will be greatly narrowed in the future. If the bullet can not be removed without performing a formidable operation it is much better to permit it to remain, and wait for additional indications, than subject the patient to additional risks incident to the operation. The modern bullet in an antiseptic wound will become encysted like the leaden bullet, and, in the majority of cases, will remain permanently in the tissues as a harmless foreign substance. If the nature of the injury makes the search for, and an attempt at, its removal necessary, the exploration should be made systematically and under the strictest antiseptic precautions.

The metal jacket of the modern bullet detracts from the value of the famous Nélaton probe, and has made the equally famous

American bullet forceps obsolete as an instrument of extraction. The porcelain bulb of Nélaton's probe will, however, answer a useful purpose in following the track made by the bullet, and in demonstrating the presence of a foreign substance in the soft tissues. The porcelain bulb of the ordinary Nélaton's bullet probe is too small, especially in searching for bullets of large caliber. It is much easier to follow the tubular wound made by a bullet with a probe, the porcelain bulb of which approximately corresponds in size with that of the bullet. As in instrumentation of the urethra, a false passage is more likely to be made with a small than with a large instrument. I have had a bullet probe made which is supplied at both ends with a porcelain bulb, one of which corresponds in size with a 22-caliber bullet, the other with that of a 38-caliber.

The porcelain bulb of the ordinary probe is very liable to become detached in exploring deep wounds, and may be lost in the wound, as happened in one of my cases. To prevent such an accident the bulbs of my probe are drilled through, the ends of the silver probe pass through, and are clinched in a depression on the surface of the bulb. In searching for bullets it is of the greatest importance to bring the parts and tissues of the body as nearly as possible in the exact position they occupied when the injury was received. That no more force should be employed in using the bullet probe than in passing a catheter is simply to repeat a cardinal rule, to which there should be no exceptions. Skill in the delicate manipulation of the instrument, patience and perseverance, will accomplish more than force in these cases. Bullets which can be felt under the skin, opposite the wound of entrance, are extracted without exploration of the wound canal. If the bullet occupies a locality where its presence would be incompatible with a good functional result, as the cavity of a large joint, it becomes usually necessary to enlarge the wound with the knife, chisel, and mallet, to follow the course of the bullet and to effect its extraction. In one case I removed a 22-caliber bullet from the center of the knee-joint by such a procedure, in a boy fourteen years of age, who recovered with nearly perfect use of the limb. A similar case is reported by Volkmann. The metal jacket of the modern bullet will make it necessary to construct bullet forceps with great grasping power to facilitate its extraction. In penetrating gunshot wounds of the skull,

W. O. Owen

FIG. 18. Saber splint for leg and thigh.

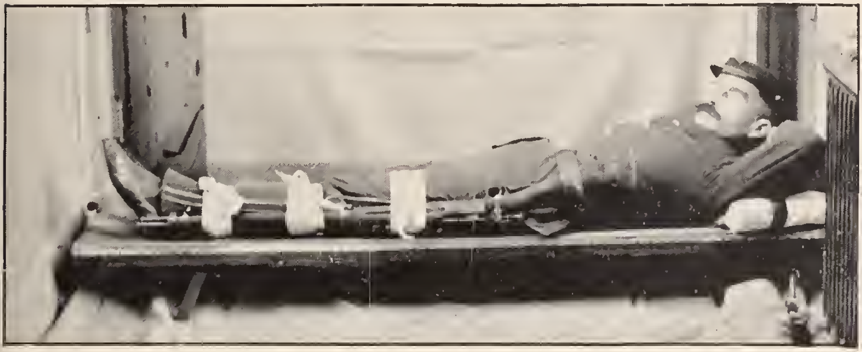


FIG. 18a. Gunsplint.

FIG. 19. Stick and blanket splint.

FIG. 20. Bark splint for forearm and wire splint for arm.

FIG. 21. Litter transportation.

FIG. 22. Manner of transferring patient from litter to ambulance.

Flührer's aluminum probe, and his technique in removing a bullet from the cranial cavity, merit the earnest attention of every military surgeon.

Craniectomy.— Operative interference is indicated in every case of penetrating gunshot or stab wound of the cranium. The object of such operation is to secure asepticity of the wound and its environment, removal of loose spicula of bone and infected foreign substances, arrest of hemorrhage by torsion, ligation or tamponade, and, if feasible, removal of the bullet.

The wound of entrance is enlarged with chisel or rongeur forceps sufficiently to enable the surgeon to meet the indications for the operation. If the bullet is lodged in the interior of the skull, it may become necessary to make a circular craniectomy in the course of the bullet at a point opposite the wound of entrance, for the purpose of establishing thorough drainage and to facilitate the removal of the bullet.

Laparotomy.— In my address at the last annual meeting I discussed the advisability and feasibility of laparotomy upon the battle-field in cases of penetrating bullet and stab wounds of the abdomen, and I shall not occupy your time on this occasion by further remarks on this subject.

Amputation.— The object of conservative surgery upon the battle-field, as well as in civil practice, is to obviate, whenever possible, the necessity of mutilating operations. Prompt and careful hemostasis, antiseptic precautions, immobilization of compound fractures and injured joints, and early and careful transportation of the wounded from the field to the temporary hospital, are the most fruitful resources of the modern military surgeon in the prevention of complications that so often necessitated intermediate and secondary amputations in the wars of the past. A primary amputation for gunshot wound of the extremities is only justifiable by extensive injuries of soft parts and fractures and joint wounds complicated by injury of large vessels and nerves. In other words, the indications for a primary amputation will be studied and sought for more by the character and extent of the injury of the soft tissues than the extent of the bone or joint lesion. In doubtful cases the patient will be given the benefit of the doubt, as, under antiseptic precautions, the risk to life is greatly diminished in the attempt to save a

limb by conservative treatment. The conditions which will demand an intermediate or secondary amputation in cases thus treated will prove less perilous to life than in the past, an additional inducement to practice conservatism in doubtful cases.

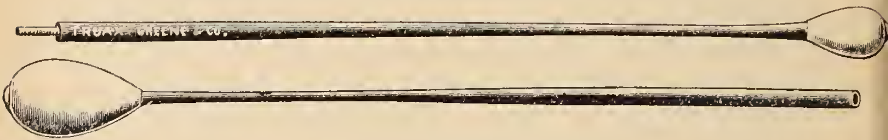


FIG. 23. Senn's Bullet Probe.

Resection.—Primary resection for gunshot wounds of joints, for obvious reasons, has become an obsolete operation in modern military surgery. The most brilliant results have already been obtained by conservative treatment of such cases. The military surgeon will make it his duty in such instances to resort to such measures as will prevent complications necessitating secondary resection and amputation. Thorough disinfection of the wound, removal of loose fragments of bone and infected foreign substances, including the extraction of the bullet, if this is found within or in the immediate vicinity of the injured joint, gauze drainage, and immobilization of the limb in a circular plaster of paris splint, are the most effective measures in accomplishing this end.

I have briefly sketched in this paper the essential topics which will engage the attention of the military surgeon in the future in keeping pace with the rapid advances of modern surgery, and which will enable him to extend the blessings of conservative surgery to the wounded upon the battle-field of the future. The members of this Association should regard it as their duty to so perfect themselves in the principles and details upon which rests ideal conservative surgery, as to apply it in practice should they be called upon to serve their country upon the battle-field.

SOME REMARKS ABOUT ASEPSIS IN MILITARY SERVICE.

BY LIEUT.-COL. EDUARD BOECKMANN,
Assistant Surgeon-General, Minnesota National Guard.

It is with some hesitancy that I venture to bring such a worn-out topic as asepsis before this distinguished assembly, which is represented by our foremost bacteriologists, our best surgeons, and by men who, perhaps, daily have opportunity to rejoice over the good fruits of their aseptic efforts; but, when I, at the same time, consider that the last word in ascpsis has not yet by any means been spoken; that our views, in consequence, are subject to change, and our opinions vary; that there yet prevails considerable difference, and even uncertainty, with regard to the value of the different means and apparatus of disinfection; that daily, partly through ignorance and partly through negligence, violence is done to the simple, but strict, laws of asepsis, and that we, military surgeons, because of the peculiar and difficult conditions under which we must exercise the aseptic art, in service particularly, should be fully conversant with the principles of asepsis, I certainly need no apology for presenting that which at first sight appears to be A B C's to us all.

Our surgical enemies, which all of us know either through our practice or through books, and which are distinguished by their ubiquity and numerousness, less by their tenacity of life, we endeavor to keep at their distance in different ways—we destroy them, we remove them, or we render them innocuous. Could we simply destroy them all this would be the most ideal procedure, but since this, unfortunately, is impracticable, we must in every case avail ourselves not only of the thermic means of disinfection which are the proper germicides, but also of mechanical and chemical measures whose usefulness consists in the removal and the inhibition of growth of the micro-organisms.

Mechanical Disinfection. — Since we can not boil our hands, nor put our patients in a steam sterilizer, and since the chemical disinfectants can not sterilize an infected skin in such concentration as can be used in practice, and in such time as is at our disposal, it is clear, and universally conceded, that the crucial point in the sterilizing process of the operator's hands and the patient's field of operation must lie in the mechanical removal of the ever-present and innumerable micro-organisms in these situations. This can also essentially be accomplished by razor, nail-cleaner, water, soap, brush, and towel; but any absolute surgical sterilization is hardly within possibility, as the surgical micro-organisms are met with not only in the deeper epidermic layers but also in the different adnexa of the skin.

That disinfection which results from a careful mechanical treatment of the skin has been made fractional by different authors, some putting it at a half, others at two-thirds, while, as is well known, there are those who, both on this side and the other side of the Atlantic, find in the mechanical moment the ideal in surgical sterilization of the epidermis. In my opinion we can not well express in definite fractions the aseptic value of mechanical disinfection, since individual differences, in the first place, obtain in high degree, and since, in the second place, mechanical disinfection is an art exercised by different operators in extremely varying degrees of efficiency. It is, unfortunately, not to be denied that those operators who really understand how to wash themselves surgically still are in the minority, which is deplorable, as I am one of the many who, by experience, have arrived at the conclusion that mechanical disinfection can nearly approach surgical asepsis if practiced intelligently. We should certainly be spared the painful spectacle of seeing a surgeon omit to remove his finger-rings, and, at the same time, it is only a reasonable demand that the shirt sleeves be rolled up beyond the elbow. It is unquestionably proper to use a razor on the field of operation, not so much for the sake of the hair as for the skin, whose disinfection is thereby greatly facilitated. The surgeon himself, by right, does not shave his arms or hands, which would be a necessity if this process should be a *sine qua non* for the disinfection, as far as the hair is concerned. The washing itself must be performed in a routine manner; first, a general soaping and

scrubbing, thereupon a special ditto of each part. The extensor surface of the arms is reached by flexion, and not by extended pronation or supination; special attention is given the finger-ends, the nails, and the folds between the fingers. The more changes of water (preferably running and sterile), the higher the temperature (up to 120° F.), the cleaner the brush (best a stiff one), the purer the soap (boiled, green soap), and the longer time devoted, the better is naturally the result. It is certainly perfectly proper that we afterward wipe the thus-treated skin with a sterile towel, and when this is done we have, in all essentials, removed what, practically, is all-determining, and we can, as a rule, proceed to any operation whatever with a good conscience and justified hope for an aseptically good result, so far as the operator's hands, and the patient's field of operation, treated similarly, are concerned.

Yet it is necessary, beyond being a good washerwoman, to be both an able and experienced operator, in order to attain aseptically good results from the mechanical disinfection, and as it falls to the lot of comparatively few to become at the same time able and experienced surgeons, it is advisable for those who are not specialists that they not only extend the traditional one minute, but that they add something more. It is customary to scrub the skin with strong alcohol, ether, or turpentine after the thorough washing with soap; the method is certainly justified, as the named articles are of recognized value in the removal of grease spots. To be sure, we advance a step further by an energetic scrubbing with one of these agents, followed by drying with a sterile towel. There are even those who consider alcohol omnipotent in the disinfection of the skin, and we can not very well contradict such a profanation; however, these strongly fat-dissolving agents make the skin dry and brittle (an unpleasant occurrence for sensitive skins); wherefore many, among them the author, have discontinued the use of alcohol, ether, and turpentine, and preferred to make the remaining micro-organisms innocuous by chemical agents, of which more below. By the mechanical disinfection we aim to the greatest possible extent to dissolve and remove the fatty skin-covering, rich in bacteria. This fat plays an important rôle in the economy of the skin; it is to keep it pliable and elastic; it is to receive and arrest, and thus prevent the innumerable bacteria which come in contact with it from causing local or universal

trouble; therefore, it appears to me proper to restore to the skin that protective we have endeavored to deprive it of, in the form of a sterile fat, not only for the sake of the skin, but also to cover up and arrest the remaining bacteria, and thereby prevent them from infecting the operation-wound. The idea is not new, but is, for the time being, hardly realized beyond examinations and operations upon the vagina and rectum. I believe that this method has quite a future in surgery generally, if we employ a material of the same composition or quality as that which is found upon our skin. Lanolin is the fat which I have used for this purpose during the past year, and provisionally I have every reason to be satisfied therewith. Lanolin is, as known, a product of sheep's wool; it does not saponify or become rancid, has a remarkable penetrating power, and sticks excellently to the skin. Lanolin absorbs water greedily, and the commercial article contains about twenty-five per cent; this is called simply lanolin, and forms an almost white salve-like mass, while the dehydrated lanolin (lanolinum anhydridum) looks like honey, and is of the consistency of vaseline. Pure lanolin is without smell or taste; anhydrous lanolin is simply sterilized by boiling; it boils at a temperature of about 400 degrees F., a temperature which instantly destroys all bacterial life. Ordinary lanolin can not be sterilized in this manner, as the contained water will be separated and, in boiling, cause the lanolin to be thrown to all sides; it must first be dehydrated, which is fairly accomplished by heating in a steam sterilizer for some time, after which it is set away to be cooled; the water will accumulate below, while the anhydrous lanolin will solidify above. When this has occurred a hole is made through the lanolin and the water emptied, after which the lanolin is carefully heated up to its boiling point over a weak flame; it is now surgically sterile.

A convenient mode of keeping sterile lanolin ready for use is to pour some into a sterile flask with glass stopper, and add to it four or five times the volume of anhydrous ether, which keeps the lanolin dissolved. If a little of this solution is poured into the hands a few moments suffice to rub it well into the skin; the ether evaporates quickly, and the lanolin remains. Another, in military service, convenient method is to run the lanolin, while melted, into collapsible tubes, such as painters use, sterilized beforehand by boiling. A small amount is pressed out and well rubbed into the skin, where-

after the excess is removed by a sterile towel and pressing out from under the finger-nails.

Chemical Disinfection.— After having softened up and removed the epidermic dirt mechanically, it is a standing rule to wash or scrub the skin with corrosive sublimate solution, to destroy the bacteria which have not been and can not be removed; theoretically, no criticism can be made against this practice; practically, I am strongly inclined to believe that the whole is a comedy of errors. It is not denied that corrosive sublimate is chemically the most powerful germicide at our disposal, but Geppert's well-known experiments, which have been corroborated by later investigators (Abbott and others), have long ago proven that it not only requires a one-to-thousand solution a long time — hours — to kill surgical bacteria, but that the latter must be exposed in pure culture — conditions which rarely obtain in practical life — not even after the most thorough mechanical disinfection. Corrosive sublimate must form a chemical combination with the protoplasm of the bacterium in order to unfold its germicidal power, which does not occur when these are imbedded and hidden in fat, albuminous material, and dirt. It is an every-day occurrence to see how a sublimate solution rolls off the skin, like water on a duck's back, without the least impregnation; the result is in the main the same, when the skin is beforehand treated with warm water, brush, and soap, and even with alcohol. No name-worthy difference is to be remarked, even with the addition of tartaric acid to the sublimate. Even if, with an energetic brushing extending over minutes, we succeed in forcing some into the skin, this impregnation is always, in the first place, superficial, and in the second, the time is too short for any germicidal action; thereto is added the wiping or washing off of the excess sublimate, whereby we, through justified fear of toxic action, renounce the antiseptic rôle which these drops could play in the operation by inhibiting the growth of present germs. For these, and other reasons, I have entirely abandoned sublimate in the disinfection of my hands, while I still recognize its value at the field of operation, when we, as is the rule in civil practice, can expose this to its continued action in weak solution for a day or two. That the skin in this manner can be impregnated, and the bacteria killed or rendered innocuous, I see a proof of in the eczemas which arise, and in the cases of poisoning

which may be the result of these wet applications, and, at the same time, that cultures from scrapings of the epidermis are negative as a rule.

The English antiseptic—carbolic acid—is by far not as germicidal as sublimate, for which reason this agent for the same purpose is used in per cents, where sublimate is used in per mille, or fractions thereof; but carbolic acid has the undeniable and great advantage over sublimate that it penetrates the skin without previous preparation of the latter. Thereupon depends its antiseptic power, and consequently the danger of poisoning. Carbolic acid will not be able to kill anything in the short time, and in the strength, which is at our disposal; it has no justification as a germicide, an agent which annihilates the vitality of the organisms, but as an antiseptic, an agent which inhibits their growth without destroying their vitality. This last is sufficient for the purposes of the surgeon, since the phagocytes immediately begin their important scavenger work, and generally with decided success, when the number of dormant bacteria is small and the virulence moderate. Although sublimate, in a concentration of 1 to 300,000, inhibits the growth of micro-organisms, while carbolic acid requires a strength of 1 to 850 to accomplish the same, the last antiseptic is preferable for the reasons above given.

In the meantime carbolic acid possesses important disadvantages. Many surgeons can not use it because it causes annoying eczemas, or, in any event, dry and chapped hands, and anesthesia. Carbolic acid as an application on the skin, mucous membranes, or on wounds, is an exceedingly dangerous agent to the organism, and cases of poisoning have both been numerous, fatal, and often compromising; for these reasons I never could persuade myself to employ this chemical in disinfection of the skin, but have cast about for an agent that possesses the advantage, but not the drawbacks, of carbolic acid.

Such an one probably does not exist; I have provisionally availed myself of lysol, which possesses its good qualities in the same or higher degree, and its disadvantages in less. Lysol is saponified phenol, derived from cresol, a coal-tar product of superior antiseptic power to carbolic acid, by the action of nascent soap.

It is a good antiseptic in a strength of one to three per cent. Lysol is viscid, brown, and strongly alkaline; it dissolves readily in water,

which carbolic acid does not do; the solution foams like soap-water, penetrates the skin easier than carbolic acid, makes the skin soft and pliable, burns a little, and causes after a short time a feeling of slight numbness; its toxic properties are not as marked as carbolic. It is, on the whole, eminently qualified for washing the hands and the site of operation, whether the skin is broken or not, while continued wet applications have, to some extent, the disadvantages of carbolic acid with regard to burning and the production of eczema, for which reason I still prefer weak solutions of sublimate for this purpose. I believe that military surgeons should adopt this practical, inexpensive, and good preparation — which is at the same time both a soap and an antiseptic—as the disinfection of hands and field of operation, according to Fürbringer's method (warm water, soap, brush, nail cleaner, alcohol, sublimate, and sterile towel), always will be impracticable in actual service.

The disinfection which I will take the liberty to recommend in military service, as well as in civil, where circumstances admit of it, is as follows: Brush the hands intelligently in a quart of hot water with a clean, stiff brush, to which has been added, by guess, a tablespoonful of lysol; then clean the finger nails. Cleanse anew the hands with a fresh solution of lysol and a clean brush, and dry them afterward with a sterile towel, and rub thereafter the hands well with lanolin from the tube; remove the excess of lanolin. In the absence of hot water employ cold for a longer time; in the absence of water simply rub the hands with lanolin, which, under all circumstances, is better than nothing. The field of operation is treated in the same way.

It is within the possibility that it might be of value to render the lanolin antiseptic with lysol where we are prevented from using both separately. As is well known, the antiseptics certainly lose a good deal of their value by being mixed with fatty substances; considerably less, however, in lanolin. In the mean time, I am not so far advanced in my experiments with antiseptic lanolin that I feel justified in expressing myself concerning this for the time being.

Thermic Disinfection.—While cold is not able to destroy microorganisms, but simply inhibits their growth, heat, on the contrary, is the best germicide. Practical application in surgery heat finds in the form of hot air, boiling water, and steam. *Hot air* is a much

more powerful disinfectant than chemicals, but it is considerably inferior to boiling water and steam. Koch and Wolfhügel have found that non-spore-bearing bacteria are destroyed in the course of an hour and a half, in hot air, at a temperature of 212° F., while spores require a temperature of at least 284° F., for three hours, for their destruction. To this disproportionately long time dry heat possesses but little penetrative power. It takes a very variable, and, at any rate, a very long time to bring the temperature up to the desired height in the articles to be sterilized, while, as a matter of experience, it is very difficult, not to say impossible, to obtain a uniform temperature in dry-heat sterilizers, for which reason the thermometer is not a safe guide. When to this is added that the dressings suffer materially in this continued and high temperature, that the instruments rust, lose in temper and edge, and that these sterilizers are both cumbersome and expensive, it is no exaggeration to maintain that sterilizers for hot air alone should only be of historic interest in surgery. However, there is one important material which seems to be most properly adapted for sterilization by hot air, viz., catgut, which, as is known, neither stands boiling water nor steam, and whose sterilization by chemical means so often has proven unsatisfactory, not to speak of the long time required. As catgut, because of its absorbability, more and more gains ground *pari passu* with the perfection of its sterilization, both as suturing and ligating material, and as I have long been of the decided opinion that the surgeon himself shall undertake or, in any case, control his asepsis, I have devised the sterilizer, which I later will demonstrate, to include also hot air, so that it can be utilized for catgut, which, so far as I can see, ought to have quite a future in military surgery, for the reason that it can be at hand in a very convenient form. Benckisser deserves the credit of having conceived the happy idea of sterilizing catgut by dry heat in double hermetically sealed envelopes—one within the other; since micro-organisms can not penetrate dry paper, the catgut will remain sterile indefinitely, if the envelopes are kept dry. This is, indeed, convenient. In this way we can carry sterile catgut in our pockets. When it is to be used, an assistant tears the outer envelope, which, of course, is infected on its outer side, while the surgeon himself, or his first assistant, removes the inner sterile covering which contains the catgut. Benckisser's idea has im-

pressed me so favorably that I long ago adopted it for all the catgut that I employ in my surgical practice, but with such modifications that I shall take the liberty to describe my procedure *in extenso*.

The raw catgut, which must be of prime quality in order to retain the necessary strength after exposure to a high and prolonged temperature, is simply cut up, without special preparation of the hands, into suitable lengths; the original bundle is divided so many times that each individual string measures, respectively, twenty or forty inches — two convenient lengths for practical use. Each of these strings is wound about two fingers in a coil, which then is wrapped up in wax-paper, and since the mercantile article is very thin and easily perforated by the free ends of the coil, the wax-paper is doubled, whereupon the whole is put in a small envelope which can be hermetically sealed, and upon which is marked the length and size. The catgut is placed as nearly as possible in the middle of the envelope, which is now ready for sterilization. When the required amount of envelopes are made up, they are arranged in a specially constructed tin box, whose bottom is perforated and whose cover is provided with a small funnel to admit easily the thermometer to the interior of the box (see illustration). The envelopes are set up edgewise, and must not be packed more tightly than will admit of free space between each one, to allow the free circulation of the hot air. According to the thickness of the envelope, which depends upon the size and length of the gut, the box will receive from 150 to 200. The catgut-box is now placed within the sterilizer; the pan is filled with cold water; the hood is applied without the cork; a thermometer, which registers up to 400° F., and short enough to be completely hidden inside the apparatus, is slipped in, so that the bulb rests upon the upper edge of the envelopes. The sterilizer is now put over the burner. For the sterilization of catgut it is important to employ a burner which can be regulated and which will not soot, since the last interferes with the raising of the temperature. We must use either a good gasoline or a gas burner, preferably with two regulating cocks. We begin with a very small flame, increasing it hour by hour until the temperature, at the end of three or four hours, is at the required point (about 284° F.). When this temperature is reached it is continued for at least three consecutive hours, after which the flame is turned off, and the catgut box

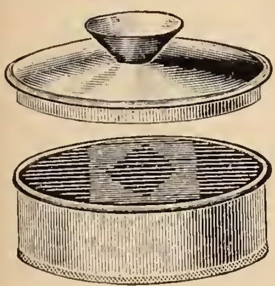
removed upon cooling — the whole procedure requiring at least six hours, three of which are consumed in the gradual heating up. As the original quantity of water — about one gallon — does not suffice for so many hours boiling, water must be added time after time; this takes place without interruption of the sterilization or nameworthy reduction of the temperature, as it is indifferent whether the water poured into the lip be warm or cold.

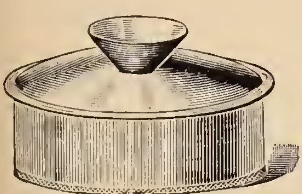
I have already mentioned that the thermometer must not extend beyond the apparatus. If it does, some of the vapor will be condensed on its projecting end, and run down along the thermometer to the bulb, which will be, to some extent, cooled off and register falsely. A loop is to be fastened to the upper end of the thermometer to allow, from time to time, its raising sufficient to read off and control the temperature. It is not difficult at all to keep the proper temperature, so much the more as it is not necessary, not even possible, to retain the temperature at exactly 284° F. It suffices that the temperatures does not descend below 280°, and preferably not above 300°, as higher degrees will burn the catgut; still, it can withstand a short exposure to 320° without being destroyed.

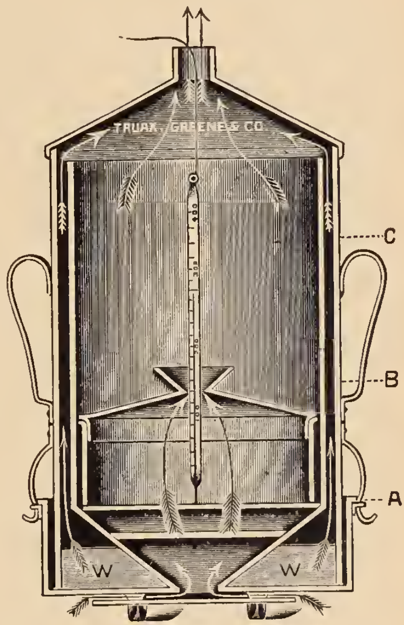
It is to be remembered that it takes time for dry heat to communicate its temperature to the envelopes and their contents, and that this communication does not keep pace with the gradual rise in the temperature of the hot air. We must bear in mind the little penetrating power of hot air, and that paper is a poor conductor of heat; consequently, it is wise to continue the sterilization fully four hours after the thermometer registers 280°, to be sure that the envelopes have had the benefit of at least three hours of this temperature, the time required for the complete destruction of the spores of anthrax.

When the envelopes are removed, after completed sterilization, we will observe that they have changed in color from white to yellow; that they are oily, especially pronounced immediately over the coil, and very slippery. The yellow color is most marked at the lower border of the envelopes; evidently the temperature has been higher at this point. This has also been the case, as is evidenced by a glance at the illustration below. The hot air in this apparatus enters from below; at the wire diaphragm, upon which the catgut-box rests, the temperature with good flame is 300° to 320° F.; the temperature sinks gradually higher up, so that it is only about 240°

in the upper part of the sterilizing chamber, because this, on all sides, is surrounded by steam at 212°, which, consequently, lowers the much higher temperature of the hot air. It is only in the lower two or three inches of the sterilizing chamber that the temperature can be raised to at least 284°; this part is alone suitable for the scientific sterilization of catgut, for which reason the catgut-box is made but two inches high, and the envelopes a little less to allow for the flange of the cover.







The bottom of the box is perforated to admit of the entrance of the hot air. The temperature is taken at the upper border of the envelopes to make sure that the whole envelope is exposed to a temperature of not less than 284°. There is, as a rule, about 20° difference between the superior and inferior border of the envelopes; therefore, the color is more brown below, and for this reason I take the simple precaution to place the catgut coil in the middle of the envelope to insure against burning, and to secure the most possible uniform temperature. After a few trials of the apparatus, and a little experience in packing the envelopes uniformly, it is hardly necessary to

observe the thermometer, because we know how wide-open to leave the regulating cocks to obtain the desired temperature; patent gas regulators are superfluous. In order to provide for free circulation of hot air between the individual envelopes, especially at the location of the coils, arrange according to the illustration.

Cultures from catgut sterilized as above have, without exception, been found surgically sterile. Even the virulent spores of anthrax are destroyed, as is evidenced by the tubes here exhibited, while the pyogenic bacteria have succumbed long before—212° F., for 1½ hours, being sufficient, as stated above, and verified by numerous cultures of my own. However, bacteriologically, sterile catgut is not always achieved. At times, colonies of hay-bacilli, and their spores, are encountered. Happily, these micro-organisms are non-pathogenic, and their destruction entails also, generally, the destruction of the catgut. If you will kindly open some of these envelopes, which I sterilized a few days ago, you will be surprised to find that the individual strands apparently have lost nothing in strength from the high and continued temperature to which they have been exposed. Reverdin, who claims the honor of having been the first to suggest dry heat as the safest disinfectant for catgut, is of the opinion that the reason why it became so often brittle in dry heat was owing to its being burnt up in its own oil. This is not my experience. At times I do find, it is true, notable variation in the strength, not in the same, but in different boxes of catgut; but this can possibly be ascribed to the fat, since the temperature has been the same in all. I believe — which Benckisser, to my knowledge, first called attention to, and which Reverdin, also, in his last book, admits the importance of — that it is the water contained in the catgut which is the determining factor. If the catgut is heated too quickly, it will be literally boiled in its own water, and catgut does not stand boiling. The heating must be slow and gradual, so that the gut will be absolutely dry long before the boiling point is reached. This is, undoubtedly, the secret. If this is strictly complied with, we will invariably find, as a result, that the catgut is in prime condition as regards strength. If the catgut, in spite of this, proves brittle, we must not seek the cause in the contained fat, but in the quality of the catgut. I use, with great satisfaction, imported German catgut, marked 00–0–1–2–3, etc.; and I spare to the poor

kangaroo his costly tendons. Benckisser removes the fat in the catgut with ether; Reverdin employs catgut delivered fat-free from the factory; I, on the contrary, retain the fat, and even envelop the catgut in wax-paper, in order to add more to it. A part of the grease goes out into the envelope, which it makes oily and smooth, but a good deal remains in the catgut itself. I do not remove the fat of the gut, because I have found, what my ordinary sound mind could predict; first, that pure fat heated to a temperature of 284° F. could not diminish the strength of the catgut either more or less than hot air of the same temperature; second, the most important — that fat-containing catgut is a much less favorable culture medium for all pathogenic micro-organisms than fat-free; and lastly, that fat-containing catgut does not soften up and become absorbed as quickly as the fat-free. Even surgically, sterile catgut is not exempt from occasionally causing sepsis; this sounds paradoxical, but can occur when sterile catgut is used under circumstances which do not or can not insure perfect asepsis. An aseptic result demands not only sterile catgut, but, also, that everything brought in contact with it is likewise sterile — hands, instruments, solutions, towels; and last, but not least, the field of operation. Provided that the catgut has not been infected in handling, but that the site of operation, where the catgut is to be used, either as a suture, ligature, or both, is not aseptic, the catgut will form a good culture-soil for the bacteria present, upon whose number and virulence the successful resistance of the fat contained within the catgut depends, leaving out of consideration the more or less effective phagocytosis — which is equivalent to the degree of vascularity of the tissues and of their integrity, together with the general condition of the patient. In the skin, which, as already stated, only with great difficulty, if at all, can be rendered aseptic, sterile catgut, therefore, will be apt to produce stitch-abscesses; this applies especially where the skin is poor in vessels and under tension. We certainly can evade this complication by adopting Halsted's painless subcutaneous method of suturing, which commends itself as a timely procedure — thereby the bacteria of the skin and its adnexa are avoided. Those surgeons who do not feel inclined to adopt this mode of suturing, and who dread stitch-abscess, must consequently renounce the use of catgut as a skin suture, and reserve this ideal material for buried sutures and for

ligatures, provided they, like myself and many others, are fully convinced of its complete security for both purposes. Were catgut rendered not only aseptic, but antiseptic, what would then be the result? Should we not expect that such catgut would be a proper material for skin sutures? The answer has practically been given long ago. Catgut which has been sterilized by means of antiseptics — which is admitted can occur — will become, in spite of this, a favorable soil for bacteria present, as soon as the chemical is absorbed, and sepsis will occur. An old experience! Chemicals have not, up to date, solved the question of the applicability of catgut in skin sutures.

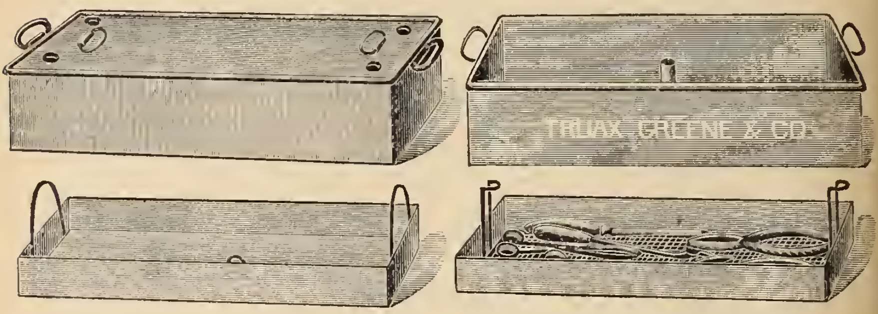
Very recently something has been written about catgut, which can be boiled after treatment with formalin, a forty-per-cent solution of formaldehyd (formol), a tanning agent of pronounced antiseptic properties. Thereby little is certainly accomplished. Formalin evaporates during boiling; the catgut, which the formalin converted into a sort of absorbable worm-gut, is sterilized like the last, only on the surface. Those micro-organisms not destroyed in the hardening with formalin — whose germicidal power in a given time is very feeble — are liberated as the catgut is absorbed from the, by the boiling water, non-affected interior. Consequently, I do not hope much from formalized catgut which can be boiled. Tanned catgut, either chromicized or formalized, has, however, an apparent advantage in being absorbed slowly. I, for my part, do not see any reason for using any other than the fat-containing sterile catgut which resists absorption sufficiently long. In order to preserve catgut as a skin-suture to the exclusion of all others, it will be necessary, so far as I am able to judge, to continue along the line indicated in retaining the fat, and to seek an agent which will render catgut an impossible culture medium, and remain with it until the last fiber is absorbed. Lanolinized catgut seems to be a step in advance, but the last word has not yet been said, for which reason I would provisionally recommend my catgut to you as a specially adapted all-around suturing and ligating material in military service.

Boiling water is an excellent germicide; it is excelled only by the free-flame, which has, however, but little practical application. Boiling water kills all surgical bacteria, spore-bearing or not, in the course of a minute or two. The pyogenic bacteria, according to Sternberg's world-famed tables, are destroyed in ten minutes by

moist heat at about 150° F., which corresponds to boiling for as many seconds. Moist heat is, consequently, disproportionately much more powerful than dry heat; the reason is not definitely settled. It is probably a purely mechanical boiling to pieces of the capsules of the bacteria. Boiling is such a safe, quick, easy, economical, and non-injurious method of sterilization, that it can not be too strongly advocated wherever it is applicable. Boiling is and will be our favorite method for the instruments. By making the water alkaline with soda or, still better, with green soap, its sterilizing power is increased, as the instruments are at the same time cleansed and the temperature somewhat increased; rusting is prevented, and the cutting edge of sharp instruments markedly little affected. The instruments must not be placed in the water before the latter boils, and it can not be too strongly emphasized that they should always be kept in first-class condition at all times. I know of no practical method of preserving instruments sterile and ready for use; if they are boiled and thoroughly cleaned after each operation, it will only be necessary to place them in a tray, and cover them with boiling water at the next operation, and they are perfectly safe after a few minutes standing.

Although the boiling of instruments can take place in any vessel whatever, it is desirable, especially on the field, to be supplied with a specially constructed instrument boiler; such an one is depicted on page 158. It is constructed on the principle of the steam sterilizer, illustrated further on, and consists of three separate parts—the boiler, the instrument tray, and the cover. The boiler is filled with sufficient water to cover instruments; some soda, green soap, or even lysol is added; the cover, formed like a pan and fitting inside the boiler, is adjusted as shown in the illustration; the apparatus is placed on the fire, while the instruments are arranged in the wire tray; when the water boils, visible at the border of the boiler, the latter is uncovered to receive the instruments. The central tube, which in no way interferes with the instruments, prevents the water from boiling over by conducting off the formed steam, which disappears invisibly under the bottom by passing over a hot plate, not shown in the drawing; the plate protects the flame from extinction by the steam. Five minutes boiling is all that is needed; the boiler is removed from the fire and placed on a stand, convenient

for the operation; the cover, which has been simultaneously sterilized, is lifted out and turned over; the instrument tray is deposited within the cover; the boiled water serves many purposes during the operation. I cherish the hope that this compact, transportable instrument boiler is eminently adapted for operations on the field.



Steam.—Water in a gaseous state follows closely boiling water in germicidal power when it has its temperature, when it is unmixed with air (saturated), when it penetrates the article to be sterilized, and when it condenses its moisture in every single particle thereof. If these precautions be observed, the articles concerned will literally be boiled in steam, resembling what occurs in boiling with water. Steam can, consequently, not cleanse anything; articles to be sterilized by steam must, therefore, be washed beforehand, if they are not clean. Steam is more particularly adapted to porous materials; solids are disinfected by steam solely on their surfaces; fluids are not sterilized by the steam itself, but by the heat communicated by the latter. In order to sterilize water, watery solutions, or emulsions, like milk, for instance, it is, therefore, perfectly indifferent whether the containing vessel is placed in steam, boiling water, or hot air.

Concerning the sterilization of fatty substances, it must be remembered that they can not derive the benefits of moist heat, because they either do not contain water, or, like lanolin, contain it in such a manner that it becomes separated. Consequently, the sterilization of fatty matters by steam means a dry-heat sterilization, ineffectual because of the low temperature.

Concerning the temperature of the steam, boiling water at the ordinary pressure of the atmosphere at the sea level gives off steam at 212° F.; this is *low* steam; the higher the altitude the less, consequently, the pressure and the lower the temperature of the boiling water and its steam. This must be borne in mind when sterilizing at high altitudes with steam or boiling water. Steam of a higher temperature than 212° is obtained by conducting it through heated pipes or into heated chambers (super-heated steam), or by evolving it under pressure—*high* steam. All pathogenic bacteria known, spore-forming or not, are destroyed in steam at 212° F. in the course of five minutes. Low steam is, therefore, as regards temperature, surgically perfect. Super-heated steam resembles hot air in germicidal power; its temperature must, consequently, be raised considerably, and it must be continued for hours in order to destroy spores. High steam, on the contrary, is more powerful than low steam. High steam at 221° will, in the course of ten minutes, kill all kinds of spores, pathogenic or not. No spores are capable of germinating when temperature of high steam of 230° F. is attained.

High steam is not only surgically, but bacteriologically, perfect. Where the temperature of low steam at high altitudes is below 212°, the sterilization must be continued beyond the above-mentioned five minutes, what we usually also do at lower-lying situations, where, for safety, we let the steam play for half an hour or more.

Concerning the penetration of the steam, we all know, by experience, how much more easily the steam penetrates than hot air. It is, in addition, a matter of fact that steam which streams from above downward penetrates to perfection every single particle of the porous materials in its path, because it, on account of its lower specific gravity than air, travels in a vertical column to a horizontal plane; while steam which streams from below upward (its natural course) preferably seeks an outlet along the line of least resistance with unequal distribution and uncertain penetration of the articles as a result. Streaming over-steam, which we might designate steam going from above downward, is, consequently, the proper steam, while streaming under-steam, which travels in the opposite direction, is absolutely to be discarded, in great as in small, when dealing with surgical sterilization of materials which are to be penetrated all through, unless these are uniformly packed—an unattainable

requirement in practical life, where the sterilizing chamber is filled with articles of most different sizes, form, and density, such as bandages, towels, sheets, cotton, etc., and which leave open spaces between them.

Steam at rest also penetrates well, particularly when it is high, though not as expeditiously and thoroughly as the incessantly streaming. Concerning the condensation of the steam, it is of considerable importance that the materials, to the greatest possible extent, get the benefit of the contained moisture of the steam; the more moist the steam operates, the more it imitates boiling and the better it sterilizes; condensation of the moisture is absolutely necessary, and will take place when the articles are of a lower temperature than the penetrating steam; the greater the difference the greater the condensation, and the more wet the articles. For this purpose the quantity of water delivering the steam cuts an important figure. The greater the quantity of water boiled the greater the amount of steam, and the more abundant the condensation. Therefore, steam-sterilizers should be constructed to hold a quantity of water proportional to the amount of articles and the size of the apparatus — half a gallon being appropriate for small sizes, and one gallon for larger. For the same purpose we must provide for good fire — preferably double non-sooting gas burners, powerful gasoline stoves, or a good kitchen fire. Alcohol or kerosene lamps are less suitable for larger sterilizers, while they can, with advantage, be employed for the small ones — for instance, milk sterlizers. Under abundant generation of steam the time of sterilization is shortened, the penetration and condensation following rapidly, and outweighs the additional time required in heating up a larger amount of water. The highest degree of condensation is attained by conducting abundantly generated steam through the coldest possible material. It takes the steam, of course, longer time to penetrate a cold than a warm article, as the first condenses more moisture than the last, and at a lower temperatnre, and as this condensed moisture must again be vaporized by the incoming steam to advance further. In order to abbreviate this time, it was formally recommended to construct steam sterilizers in such a manner that the contained articles could be heated by dry heat before the steam was turned on; this would, consequently, highly facilitate the penetration by reducing

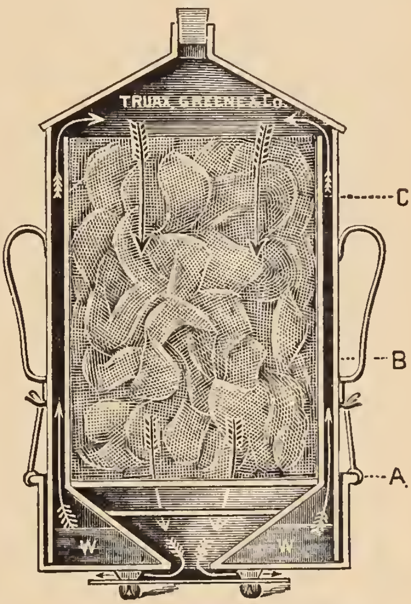
the condensation, apparently saving time. Yet this heating up beforehand is largely a thing of the past; the time gained is lost in heating up the articles, and this is most weighty; we lose, to a great extent, the all-important advantages of an abundant condensation. It is a remarkable and at the same time a welcome circumstance, that the temperature, during condensation and the following vaporization of the condensed moisture, increases beyond the original temperature of the steam, and it rises higher the larger and more tightly packed the apparatus is — up to 218° F., and even more. The reason of this can provisionally be indifferent, it is enough for our purpose to point out this happy occurrence. This increased temperature lasts about one-fourth hour; when the condensation is complete, the condensed moisture again vaporizes and the steam flows unhindered and free, the temperature dropping to the normal. During the condensation and vaporization with their increased temperature, the determining and essential sterilization takes place; later on, the steam works with little or no moisture, and, therefore, with little efficacy, if with any at all. At any rate, the first fifteen minutes are more important than the same number of hours afterward. Concerning, finally, the saturation of steam, or freedom from admixture of air, all agree that it is of capital importance that all air contained in the sterilizing chamber must be completely expelled, so that the chamber can be filled with pure steam, as heated air has considerably less sterilizing power than steam. It looks very peculiar that modern German and American authors, who, in their books, take special pains to emphasize this point, without hesitation construct, picture, and recommend apparatus which in no wise comply with the laws they themselves have subscribed to.

It is an easy matter to expel the air completely from an apparatus constructed for streaming steam; the steam itself will effect this, provided it enters above and leaves below, since it, as above stated, is lighter than air, remains on top of this, and drives it out with a piston's action. If the steam enters below, it will hurry upward through the contained air and leave above; it will certainly carry with it a good deal of air, but never all of it, as the air is too heavy for it, and it has not the power, abundance, and uniformity. Under such circumstances, it is no criterion that every part of the steriliz-

ing chamber shows a uniform temperature of 212°, as the retained air will be heated to the temperature of the steam. We have then, in the same apparatus, air at 212° F. and steam at 212° F., and this justifies me with great positiveness to insist that surgical steam-sterilizers for under-steam are scientifically wrong and practically useless — at any rate, unreliable. We must vigorously demand that apparatus for streaming steam must be constructed for *over*-steam, whether they are large or small, stationary or portable. In apparatus for steam at rest, the air must also be expelled; this is attempted by the aid of a stop-cock on top, opened three or four times as the chamber becomes filled with high steam. The mass of steam is then so considerable, powerful, and compact that we reasonably expect to expel the air almost to completion, but not with the positive certainty as is the case with over-steam. After the above-laid-down principles for disinfection with steam, we arrive at the result that low, streaming, wet, saturated over-steam is surgically perfect, and that high, at best, wet, saturated steam is not only surgically, but also bacteriologically perfect. On either of these principles our surgical sterilizers must be constructed. The crucial question is, on what principle the most practical apparatus can be built. It is not very difficult to answer this question, when we consider that a sterilizer shall not only sterilize, but that it shall also deliver the sterilized articles perfectly dry. French authors, who are so clever to throw up to the faces of the German surgeons that they rely upon inferior apparatus, because they have adopted Lautenschlager's surgical sterilizer, while the Frenchmen employ Chamberland's bacteriological autoclave, forget that their sterilizers do not deliver dry materials, and that their results do not out-shine those of their German confrères. Chamberland's autoclave, for high steam, is viewed as a steam-sterilizer — an ideal. Viewed from the standpoint of a surgeon, it is far from it. It must be compactly built to withstand the high pressure; this makes the apparatus expensive and unfit for transport. It is impossible on the field. The autoclave is intended to be a stationary apparatus. Provisions necessary to measure temperature and pressure, to make it tight, and to allow the escape of air and steam, complicate the otherwise simple construction, and increase the expense. And last, but not least, when sterilization is completed, after half to one hour, according to the size of the

apparatus, and the sterilized articles are removed, they are moist and must undergo an extra process to become dry and fit for use. Even if the autoclave, which, in my opinion, belongs in the laboratory only, can be recognized and adopted in large hospitals with great means and facilities at their command, it will be because of the above-stated reasons; at any rate, never be adapted to smaller hospitals, individual surgeons, and for the field.

Let us now, on the other hand, see how we can meet the designated requirements as regard sterilization, drying, transportation, and economy, in apparatus, constructed for over-steam. In the following illustration is pictured an apparatus, which has cost me much money and much costly time to bring down to that perfection and simplicity I claim to be its principal virtue.



My sterilizer consists of three essential parts: A basin (*A*, the water pan), an inner cylinder (*B*, the sterilizing chamber), and an outer cylinder (*C*, the hood). The basin and the inner cylinders form one piece, the outer cylinder another, and these two parts are, for transportation, held together by means of a clasp. The bottom of the basin is perforated by a circular opening, a good inch in diameter, corresponding to a similar one in the lower conical end of the inner cylinder; these two openings are seamed.

The diameter of the inner cylinder is one inch less than that of the basin, and the conical projection of the same begins at the level of the upper border of the basin, which is about three inches in height; at the junction of the inner cylinder and its cone is a wire diaphragm of galvanized iron; between this and the opening below there is a square tin plate. Under the bottom of the basin is

adjusted an iron plate, a quarter of an inch distant. The outer cylinder fits accurately within the basin; it is, consequently, a short half-inch distant from the inner cylinder, and extends half an inch above the latter; it ends, conically, above in a short tube, fully an inch in diameter, for the reception of a cork; it is provided with handles. The basin has a lip, for filling and emptying, not shown in the illustration.

Directions for Use.—Place articles to be steam-sterilized in the sterilizing chamber, tightly or loosely packed, as desired; adjust the hood, put in the cork, fill the water pan, and place the apparatus over any good flame. When the water boils the generated steam will ascend in the narrow space between both cylinders, and, as the cork prevents its escape above and the water its escape below, it must work its way through the sterilizing chamber and the contained articles, leaving by the lower opening after having driven out the air contained; here it meets the glowing plate, which converts it into invisible, super-heated steam. That lively generation of steam occurs, despite the fact that none is visible, we know beforehand can be ascertained by lifting the cork. During the boiling some steam is condensed by the outer cylinder on its inside; the steam condensed in the conical part of the outer cylinder will not continually drip down on the contained articles, because of this part's conical form, but will run back into the basin. After completed sterilization, which requires from one-quarter to one hour, according to the size of the apparatus and amount of packing, from the time the water boils, the steam contained in the articles must be expelled in order that it shall not moisten the contents when these are removed and cooled. This is accomplished by removing the cork, regardless whether the flame be turned off or not, or the apparatus removed. All steam, both that given off by the water and that contained within the sterilizing chamber and contents, will hasten to leave the apparatus through the upper opening, and it will not take many minutes before the steam is nearly all gone and the articles dry. The articles nearest the diaphragm are first dried, both because the steam first leaves them and because hot air enters the sterilizing chamber from below—to take the place of the departing steam. The iron plate under the bottom retains its heat for a long time, and the air, which must pass over it to enter the apparatus,

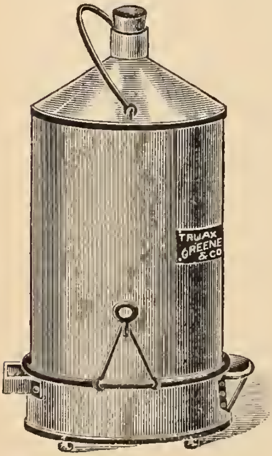
will be heated correspondingly. The uppermost layers will be dried last, since all the steam contained must pass through them; the close proximity of the steam generated from the water assists in keeping them slightly moist, but this can be remedied by emptying the water after completed sterilization.

Larger apparatus, which, by their weight, makes emptying difficult, are supplied with an extra cover for the inner cylinder to protect the contents from drip. During the drying, which is accomplished whether the apparatus is over the flame or not, the temperature of the articles drops considerably below that of the steam (down to 170° F. or still lower), despite that the inner cylinder is surrounded upon all sides by water and steam of 212° F., and despite that hot air of 400° F. enters the sterilizing chamber from below. This is the recompense for the increased temperature, which, as mentioned, occurs during the condensation and vaporization. As is made apparent, the sterilizer constructed by me, originally devised for steam sterilization, is likewise an apparatus adapted, not only for drying, but also for sterilization by hot air — the last being mentioned under catgut. If the apparatus be placed over the flame without a cork in the upper tube, the generated steam will leave the sterilizer through this. The inner cylinder will, consequently, be surrounded by water and steam at 212° F., while no moisture or steam enters its lumen. At the same time a draught is brought about in the inner cylinder in the direction from below upward, as in any vertically placed pipe; the air entering through the lower opening will consequently be heated by passing over the hot plate; the temperature of this hot air is about 400° F. at the moment it enters the apparatus. As this temperature is scorching, the above-named tin plate is placed in its path, midway between the opening and the diaphragm. This plate will absorb the heat and again irradiate it; acts, consequently, like a damper and at the same time an irradiator, with the result that the temperature at the level of the diaphragm will be about 100° lower, or 300° F.—a temperature which does not scorch; at any rate, not in the time concerned. Under sterilization of catgut is mentioned how this temperature is reduced gradually as we approach the top, as the inner cylinder itself is only at 212° F., the temperature of the surrounding steam, and thus acting refrigeratingly. In the upper part of the sterilizing chamber the

temperature of the hot air is about 240° F. The dry heat is subject to variations in the various apparatus; it is dependent, first of all, upon the strength of the flame; further, upon the thickness and size of the hot plate; upon its shape and its distance from the bottom of the basin; furthermore, upon the diameter of the lower opening of the sterilizer; upon the size of the tin plate; upon the size of the apparatus itself, etc.

I originally constructed my sterilizer for steam and for hot air combined, in order to dry steam-sterilized articles to a perfection not obtainable in any other apparatus, but when I found that it was possible also to control the dry heat, I devoted my attention to construct a special one for sterilizing catgut also, while I have not paid any special attention in that respect to those apparatus which are to be used for steam-sterilization and drying only.

I would be pleased if I have been so fortunate as to convince you that my sterilizer is not only surgically perfect in a scientific respect, but that it also practically posesses material advantages. The simple construction secures a reasonable price; there are no stop-cocks, regulators, or safety valves; a thermometer is superfluous, except for catgut; there are no solderings, which, by melting, if the sterilizer goes dry, renders it useless; everything is seamed. It is, consequently, durable, especially when made of copper, and it is at the same time light and transportable. If it falls and becomes dented, it is the work of a minute to straighten it out. The change from steam to dry heat is simply effected through a cork, which is deposited in the lip of the basin when not in use. It is a matter, of course, that it has scientifically been tested and withstood the trial; practically, I never had any reason to suspect that it failed me. The model, which commends itself for use in the field, is illustrated opposite; it can be easily transported in a suitable wooden box.



It is deplorable that instruments can not be sterialized in steam without rusting; the steam can, unfortunately, not be rendered

alkaline. Cathcart has certainly demonstrated that instruments do not rust in steam, when previously heated to 212° F. before the steam is turned on. I have tried this method extensively, and can verify the truth of Cathcart's assertions, if we are very particular in heating, and do not allow the instruments to be cooled off in the sterilizer after sterilization, but I abandoned the procedure as soon as I realized that boiling was so much more simple, and when I suspected that it was more than dubious that the instruments were disinfected by this method. If the instruments are of the temperature of the steam admitted, no condensation will take place; the instruments will remain dry, and, consequently, unaffected both by moisture and by rust, despite that they are steamed. Instruments must be steamed while cold in order to be sterilized, and then they will rust.

It is, nowadays, fashionable to construct apparatus for combined boiling of instruments and steaming of dressings. I, myself, have long ago cherished the same thought, but have arrived at the conclusion that instruments and dressing should be sterilized separately. It is an easy matter to construct apparatus for combined sterilization, if we will employ under-steam, as Schimmelbusch and Beck have done, but I, for my part, will not agree to break with my own and, at the same time, universally recognized principles, for the sake of such an insignificant trifle. Both Schimmelbusch, Beck, and I have condemned under-steam upon principle, as it is mixed with air; besides this, the articles sterilized remain wet, as they can not be dried unless they are removed and shaken — a very unsurgical operation; and, as far as over-steam is concerned, I have, some time ago, in the "Medical Record," pictured an apparatus for combined boiling, steam, and dry heat, but I do not recommend it for instruments anyhow, as the boiling pan will require too great dimensions, so far as a transportable apparatus is concerned, when they are to be made circular in form, the most convenient for sterilizers.

In conclusion, a few words in regard to our dressings, which are particularly fitted for steam sterilization.

They can, in the course of half an hour, be made ready for use in a transportable or smaller apparatus. In military service it is, however, very desirable to have them ready without notice. I have

already demonstrated how we can always have ligatures and sutures at hand in sterilized form; I have not been able to do the same for the instruments, while Bloch has, happily, solved the question for the dressings. He has proposed to wrap them up in blotting paper, in double layer.

Blotting paper is impenetrable to micro-organisms as long as it remains dry, while steam penetrates it with ease. We arrange, therefore, the materials in small packages, and mark the quantity and quality upon the outside. These packages are placed in the sterilizer, steamed and dried in the ordinary manner. To protect against moisture, they should subsequently be placed in tin boxes. These packages remain aseptic as long as they are kept dry; if in doubt, they are given an additional sterilization. Anyone opens the outer blotting paper, while the surgeon, or his first assistant, takes the inner wrapper, which holds the dressings. I believe that Bloch's method is eminently adapted to military surgeons, who must exercise their important and responsible work under exceptional and difficult conditions.

SEPTIC BULLETS AND SEPTIC POWDERS.

BY LOUIS A. LA GARDE,
Captain and Assistant Surgeon U. S. Army.

Volume LVI., No. 17, of the New York Medical Journal, October 22, 1892, contains a special report to the Surgeon General, U. S. Army, entitled, "Can a Septic Bullet Infect a Gunshot Wound?"

The evidence adduced in this report proves beyond doubt that projectiles from hand weapons, at least, are not purified by the act of firing, and that, when a specific virulent micro-organism, like the bacillus anthracis, is placed upon a projectile, and the latter is fired into a susceptible animal in such a manner as to wound him only, the animal will succumb to the corresponding infection in the majority of cases.

The experiments on animals, detailed in the special report to the Surgeon General, were conducted at short range — never more than ten feet.

The question has often been asked whether it might be possible for bacteria to remain on a projectile during and after its transit at the actual ranges of — say, three, five, six hundred yards, or more.

Without such experimental data the work detailed in the report quoted hitherto remains incomplete, and for this reason the following experiments were conducted at Fort Logan, Col., May 10, 1895.

Five sheep were shot at three and five hundred yards with the 230-grain steel-jacketed bullet of the .30-caliber Krag-Jorgensen rifle. The projectile was propelled by thirty-seven grains of Peyton smokeless powder.

Each projectile was infected a few moments before the firing took place with a recent virulent culture of the bacillus anthracis on an agar-agar slant. Four of the animals were wounded. One was killed outright; the bullet from the 500-yard stand, which passed through the large vessels of the neck, caused death by hemorrhage in a few minutes.

Of the wounded animals, No. 1 received a wound at 500 yards on the inside of the right ham, near the shank. The projectile passed out, fracturing the ham-bone. Death ensued sixty hours after the injury. Cover-slip preparations from the blood of the liver, spleen, and heart, stained with a watery solution of gentian violet, revealed the bacillus anthracis. Colonies of the bacillus anthracis were isolated on agar-agar plates inoculated from a bouillon suspension of the blood from each of the organs mentioned.

No. 4 was hit at 300 yards in the left shoulder, the projectile making its exit on the right side of the neck. He never recovered from the effects of the injury sufficiently to enable him to regain his feet. He refused food and drink from the time he was shot until he died on the fifth day. Cover-slips prepared from the blood of the spleen, liver, and heart showed anthrax bacilli in nearly every field.

The other two animals, shot in the skin of the abdomen and in the right foreleg, respectively, at 300 yards, recovered entirely.

These results show conclusively that the infection of anthrax can be carried on a projectile at long range, and that it is possible to thus infect susceptible animals.

SEPTIC POWDERS.

1. *Black Powders.*— The extent of powder burn, tattoo, or marks inflicted at short range by fire-arms, etc., as observed in surgical practice, will convince any one that the charge of powder is not entirely consumed in the generation of gases at the time of ignition. If one will recover the powder grains that can be caught in blotting paper from firing revolvers at short range, and place these together or singly in a vessel, it will be found possible to ignite them, almost invariably, with a burning match, showing that the grains of powder that produce the tattoo of what we style powder-burn are not destroyed by the act of firing.

It is estimated that only fifty-seven per cent of the old black powder is consumed in generating the gases that cause the explosion, and that the remaining forty-three per cent is thrown out in the original granular condition, each grain acting as a missile, with velocity sufficient to inflict injury, the extent of which varies with the

size of the powder grains, length of barrel, distance of the body from the muzzle, etc.

The bacteriology of gun powders before and after firing, and the possibility of transmitting micro-organisms that may contaminate them into media or wounds at the moment of ignition, is, I believe, a subject that has received no attention prior to the experiments about to be enumerated.

The black gunpowder generally used in fire-arms is invariably contaminated with dirt, dust, and other impurities. This fact is so apparent that it hardly needs proof to demonstrate it. Still it was necessary for the purpose at hand to verify the matter, which I did, as follows:

Six gelatin rolls (Esmarch plates) were prepared, each containing six grains, by weight, of Dupont's "F" black powder, such as our Army has been in the habit of using for reloading the ammunition of the Springfield rifle and carbine.

Six bouillon tubes were similarly inoculated and placed in the incubator at 35°-37° C. The latter were cloudy after the lapse of twenty-four hours, and hanging drops as well as cover-slips prepared from the different cultures contained bacteria of many different kinds.

The gelatine rolls (Esmarch's plates), after forty-eight hours at the room temperature, were invariably studded with colonies, varying in number and kind.

Sterilized black powder, when fired against plates of gelatine or agar-agar with blank cartridge or ball, at short range from revolvers, rifles, or carbines, imparts no growth to the media in the majority of instances. When growth appears it is very sparing in the number of colonies. These may arise from the current of air that is forced against the plate with the expanding gases, or possibly from imperfect sterilization. The method of sterilizing adopted was to place the ammunition in an Arnold's steam sterilizer for two hours. This does not always succeed, as some of the powder will show growth now and then when placed in suitable media.

As a matter of contrast to the negative results obtained by firing sterilized black powder into gelatine or agar-agar plates, if we take forty grains of black powder and mix it with ten grains of dust from the street, and fire the charge from a 45-caliber Springfield carbine

at, say five feet, into gelatine or agar-agar plates, the plates will be found rich in colonies after the lapse of the prescribed time.

The experiments so far having justified the belief that unburned grains of black powder might be made to carry micro-organisms into media, I determined to make the matter surer still by attempting to inoculate powder with a specific germ.

I therefore inoculated black powder with anthrax spores, as follows: The culture used was an old one, on an agar-agar slant; the spores were mixed with fifty-five grains of powder taken from a shell of the 45-caliber Springfield carbine. The charge of powder was poured on a piece of white paper, and a platinum needle, properly sterilized in the flame, was passed once into the culture of anthrax spores and then a number of times in and through the powder until the grains of the latter no longer adhered to the needle. The needle having been again sterilized, it was once more passed through the culture, thence through the powder as before. This was repeated four or five times for each charge of powder, six in all.

The powder and ball were replaced in the shells. Two Petrie dishes containing agar-agar were placed in wire frames, and the latter were suspended against the target, four inches apart. The marksman, who held the muzzle of his carbine at five feet, was directed to locate his projectile as nearly as he could midway between the two plates. In this way a number of powder grains were collected on each of the twelve plates, out of the six shots fired. The plates were at once placed in the incubator at 35°–37° C. At the end of twenty-four hours four of them contained colonies of the bacillus anthrasis.

Having recovered this uncommon germ in the manner stated, the proof seemed conclusive that contaminated black powder was apt to carry germs of any kind, on those grains which had not ignited, into media, and, possibly, into animals.

To demonstrate the latter proposition, I loaded six blank cartridges, each containing eighteen grains of black powder infected in the manner described with anthrax spores. The weapon used was a 38-caliber Colt's revolver, range one foot. Six rabbits were selected, and each animal was shot in one or both ears. In four of the animals the unburnt grains of powder failed to penetrate the skin entirely—the grains projected above the surface; while in the

other two the powder grains were, for the most part, well imbedded in the skin and areolar tissue. The latter two animals sickened on the third day. One of them died on the fourth day, while the other reeovered entirely. Cover-slips, prepared from the blood of the heart, spleen and liver, of the dead animal, stained in a watery solution of methylene blue, revealed anthrax baeilli in nearly every field.

2. *Smokeless Powder.*—The experiments about to be described were conducted with the Peyton smokeless powder, now used by the United States Army, in the Krag-Jorgensen rifle. Although we have every reason to believe that this powder is contaminated by handling in the same way that the old blaek powder is, yet we fail to obtain growth when we plaee a few grains of it in media-like bouillon, gelatine, agar-agar, etc. This powder imparts a yellowish eolor to the media. After repeated trials I have failed in cultivating prodigiosus in bouillon to which a few grains of the powder had been added. It would seem from this that the Peyton powder eontains a substance which inhibits the growth of certain baeteria in the medium mentioned.

On the other hand, if a bouillon tube containing a few grains of the Peyton powder be inoeulated with anthrax spores, growth will be noticed at the end of twenty-four hours under favorable conditions of temperature, showing that the restraining influenee of the powder does not apply to the more resistant forms of germ life.

If the experiment of firing black powder into agar-agar or gelatine plates be repeated with the Peyton powder, whether this be sterilized or not, the powder grains whieh are caught on the medium impart no growth, as a rule. The yellowish diseoloration already mentioned is invariably noticed around each grain.

If, however, we purposely mix earth, in the proportion of ten to twenty per cent, with the powder before firing, eolonies will appear in great numbers in the medium beyond the areas of diseoloration, and sparingly, if at all, within the latter.

Out of six gelatin plates fired into at ten feet with the Peyton powder, whieh was previously eontaminated with anthrax spores, eolonies of the baeillus anthraeis were observed in two of the plates.

Of three rabbits shot in the ear at four feet by the Krag-Jorgensen rifle, loaded with thirty-seven grains (blank cartridge) of the Peyton powder, which had previously been eontaminated with anthrax

spores, in the manner already mentioned, with black powder, one of the animals sickened on the third day and died on the fifth day. Cover-slip preparations, properly prepared from the blood of the spleen, liver, and heart, and stained with a watery solution of gentian violet, revealed the presence of anthrax bacilli, though few in number. Sections of the liver and spleen, stained by Gram's method, exhibited the presence of the same bacilli in the vessels.

CONCLUSIONS.

The experiments and their positive results, as enumerated in this paper, as well as those detailed in a paper read before the Pan-American Congress, and also in the paper already mentioned in the New York Medical Journal of October 22, 1892, offer, in my opinion, a reasonable explanation for the occurrence of various infections, like tetanus, malignant edema, erysipelas, etc., in a fair proportion of the cases following gunshot injuries.

H. Nimier, a French Army Surgeon, in the Archives de Medicine, et de Pharmacie Militaires, No. 23, 1894, relates four cases of tetanus after powder-burn from blank cartridges. The injuries were inflicted during sham battles. The relief corps were promptly on the ground, and, although all antiseptic precautions were observed, infection took place. In a recent letter, Dr. Nimier informs me that the powder which caused the injuries was the old black powder.

Cases like these are difficult to comprehend, unless we assume that the gunpowder was infected, or that, as often happens, tetanus earth had become accidentally lodged in the muzzle of the guns.

I believe that my experiments and their results justify the opinion that the infection of tetanus and malignant edema can be conveyed by one or both of the ways mentioned, and, unless I shall be forestalled in the attempt, hope to be able to demonstrate this as a fact to the Association at no distant day.

SOME CONSIDERATIONS CONCERNING THE LOCATION AND DETECTION OF MISSILES.

BY ROSWELL PARK, A. M., M. D.,

Professor of Surgery, Medical Department, University of Buffalo, ex-Major and Surgeon, Fourth Brigade, N. G., S. N. Y.

That great master of surgery, Ambrose Paré, taught even more wisely than he realized that gunshot wounds were not, as had been previously supposed, necessarily poisoned wounds, and that there was no necessary toxic action to be attributed to either the passage of the bullet or its lodgement in any particular part of the body. He inferred what others more completely demonstrated, and what is now an established axiom, that a bullet wound *per se* is dangerous only in proportion to the damage which it has inflicted in its course. Still, for a long time after his day, it was held that such a wound could never heal without suppuration. Even the older Langenbeck and Stromeyer both laid down maxims to this effect. Nevertheless, Hunter and Bell had noted that the wound of exit could heal without suppuration, and Roux, Jobert, and Baudens reported numerous instances occurring during street riots in Paris, where both the wounds of entrance and exit healed under a crust. Pirogoff also often observed the same thing. Simon collected a number of cases where, with the exception of a little serous exudation, there was no trace of fluid discharge. Still later, and during the Franco-Prussian war, Fischer, Esmarch, Verneuil, and others noted many such cases. During the Turko-Russian war the subject was studied especially by Bergmann and Reyher. These, and many others, whom we can not now stop to name, clearly demonstrated the fact that it was quite possible for a gunshot wound to heal without the slightest sign of toxic action or infection—a matter which it was not only of the greatest importance to establish, but one which

has entirely changed the conventional course of action in dealing with such cases.

For, so soon as surgeons were given to understand that a bullet wound was usually *per se* an innocent sort of a wound, the principal argument for removal of the bullet was at once vitiated. In consequence, an entire modification of former teachings was brought about; and the object of this paper is mainly to discuss methods which are to be resorted to when exceptional cases call for some apparent violation of the precept that a gunshot wound is one rather to be let alone. In other words, we have at present to concern ourselves with two principal topics:

1. Under what circumstances is a gunshot wound to be interferred with for removal of missiles? And,

2. How are said missiles to be located or detected?

The answer to the first query will be a somewhat indirect one, and based upon certain considerations, of which the following are the more important: Bullets—for we may confine our discussion practically to these—are to be removed when, first of all, they are doing actual harm; secondly, when their removal will improve the appearance or the comfort of a part, *i. e.*, for anodyne or cosmetic effects; and, thirdly, occasionally when patients are not convinced by the logic of such arguments as I shall set forth, but insist on their removal at almost any hazard. I am well aware that it is best not to deal with this third class of patients at all, although once in awhile one can scarcely avoid their presence, or their convictions and earnest desires. The first consideration is so closely connected with the useful, or harmful use, of the probe that I find it difficult to dissociate the two topics, and prefer to deal with them together, since the considerations which shall lead us to avoid probing are among those which enable us to decide whether a bullet is still doing harm or not.

The injury which a bullet may inflict is done, for the most part, during its course; and, for the most part, too, any subsequent harm is largely due to unwarranted interference. Moreover, a leaden bullet imbedded in the tissues is *per se* an innocuous and inoffensive substance, as experience has abundantly proven; while, unless other and poisonous material has been carried into the tissues, nothing has entered which, except from anesthetic motives, needs to be

removed or is likely to do harm. First of all, then, general observation of the patient's condition will show whether a vital part has been injured or not. A study of the pulse, respiration, of the amount of shock, of the amount and character of hemorrhage, of signs of interference with nerve plexuses or individual nerve trunks, will give, for the most part, perfectly reliable information, and of greater extent and more accurate than can possibly be obtained by mere probing. A study of physical signs, moreover, will probably indicate whether the lung or the pericardium have been perforated; whether the bowel be intact; while the passage of the catheter will give information as to the condition of the bladder.

It follows, then, that a study of bullet wounds, or of the effect of bullets, as well as their location, is to be based upon two quite different lines of procedure, which I will indicate as,

A — The rational; and,

B — The mechanical.

In further elaboration of the rational plan, I would speak of, first, the pain and loss of function of the injured part. The wounded arm usually drops helpless; upon the wounded limb the individual walks with great effort, if at all; while in gunshot fractures locomotion would be ordinarily out of the question. We must not forget the law of neurophysiology — which is seldom, if ever, violated — that pain produced by lesion in the course of a nerve is referred to its peripheral distribution. There are, however, occasional exceptions to this, which are most notable. After injury on one side the pain is sometimes referred to the opposite side. Attention has been recently called to this peculiar contradiction by Weir Mitchell (Med. News, March 16, 1895). And even in military surgery one may find occasional instances of this character — as, for instance, pain in the right hand after injury of the left; pain in both elbows after gunshot wound of the neck; pain in the left arm after gunshot wound of the testicle. Pain is usually inversely proportioned to the degree to which the individual is distracted at the moment of its reception. Many an individual, wounded in the rage of conflict, is little, if at all, conscious of pain at the moment of injury. Absence of pain may, therefore, be referred to excitement or to mental diversion — of course, up to a certain limit. Wounds which involve the soft parts alone, and which do not concern those regions of the body par-

ticularly well supplied with nerves, give rise, as a rule, to little or no pain; and, by virtue of their exemption from painful features, such wounds may usually be regarded as among those which call for no interference. Other things being equal, the degree of pain is proportioned to the length of the gunshot canal. Wounds, with more or less crushed and injured borders, are less sensitive than those with a minimum of such disturbance. Gunshot wounds of bone, especially with displacement of fragments, are among the most painful — particularly so when fragments press upon nerve trunks, or even nerve fibers. There is usually no reliable difference in sensitiveness of the wound of exit and that of entrance.

Anesthesia in the neighborhood of the gunshot wound is a symptom deserving of further study. It may be the result of contusion and laceration, in which case it merges into normal sensitiveness, as one tests cutaneous sensibility along lines radiating from the wound itself. Berger found, in a large number of cases of injuries of the soft parts alone, a diminution of sensibility in the immediate neighborhood of the cutaneous wounds, and this not only of the skin, but in the mucous membranes when they were involved. In appropriate cases it would be well to test the sense of taste and the muscular sense, as well as the electro-sensibility.

When large nerve trunks have been injured we get not merely anethesia, but motor paralysis. In case of inability to move a given part, it should be decisively estimated whether the functional disability be due to nerve injury or to some other lesion, as of tendon, muscle, ligament, etc. This can ordinarily be easily and promptly determined.

It may also be possible to draw conclusions of importance from a study of ecchymoses, or of other appearances, among which emphysema is probably the most important and characteristic.

A symptom of considerable importance, to which Pirogoff has alluded as "local stupor," and which Bardeleben has called "local shock," is sometimes to be noted, especially in injuries to the extremities. In these cases the ordinary programme is considerable complaint of pain, then of loss of sensation, after which the parts become paler, surface temperature reduced, and the patient acts with reference to the limb much as one does when, as the common expression goes, an arm or a foot "goes to sleep." The local appli-

cation of heat, sometimes with rubbing, will improve these local conditions. This condition may be very temporary, may last for some hours, or may merge into one of paralysis of both sensation and motion; or, finally, it may merge into one of complete and generalized stupor or shock. In some of these instances a nervous trembling, either of the injured part or of all the muscles, is a conspicuous sign. This has been spoken of by Keen as the "traumatic hysterical state." It is worth while also to note that these conditions are brought about particularly after injuries to the fingers, toes, or the external genitals; while shock, in general, is more common after injury to the abdominal viscera or to the abdominal walls along with them, than under most other circumstances. For instance, among 100 cases of death after a fight, noted in the British troops in the Crimea, twenty-two were directly ascribed to shock, the patients dying within from three to twenty-four hours after injury.

There should also be mentioned here a peculiar form of tetanoid convulsion, which one occasionally meets with upon the battle-field. This was frequently noted during the campaign in the Crimea, and has been described by a number of writers. It has been seen particularly often, too, as a post-mortem condition, in which the dead body is found in much the same position as it was when injured, as, for instance, the dead body of a man found leaning against a tree. It would appear that muscle contraction in these cases persists after death. This is more probable than the explanation that one has to deal here with a post-mortem muscle spasm. This has been spoken of, for instance, as the "cataleptic condition of the dead." Concerning the etiology of this interesting condition, however, this is scarcely the place to deal.

The quantity of blood lost, the character of the act of bleeding, and the appearance of the blood, will quickly indicate whether a large artery or venous trunk be severed. If such have been the case, the individual will probably not long have survived the injury unless prompt help were afforded. Of course, such a lesion would call for prompt operative interference, for entirely different reasons and of entirely different character than that required for removal of the bullet, although possibly the latter might be super-added to the former. On the other hand, ligation of a vessel at point of elec-

tion, or some other measure, might be indicated at a point considerably removed from the location of the bullet. So, could it be once established that a nerve trunk of considerable size had been divided, it would be eminently judicious in many instances to promptly operate for repair of this particular injury by nerve suture, without reference again to other lesions. But this fact would be made known by a study of the signs, *i. e.*, by the rational method, and not by the mechanical.

Those gunshot wounds about which most perplexity in these respects may arise, are probably gunshot fractures or gunshot perforations of the principal cavities of the body. The remarkable results reported some years ago by Reyher have clearly indicated, however, the wisdom of the non-operative course in not a small proportion of cases of gunshot fracture, which are, of course, compound fractures. In the remarkable results obtained by him during the campaign in the Caucasus, vastly better results were obtained from non-interference by the method of primary antiseptic occlusion than were ever obtained before, or can now be obtained in any other way. The conclusions which he then drew, and the methods which he practiced with such brilliant results, are to be modified to-day only to a slight degree by the differences in missiles used by the armies of the day, and by the somewhat altered character of the injuries produced under these altered conditions. Nevertheless, the conical steel bullet will scarcely ever inflict an injury upon a bone or joint whose proper first treatment can not be comprehended in the canon of primary antiseptic occlusion, the exceptions here being mainly those violent disintegrating actions which would call for resection or amputation. The gunshot fracture of the knee-joint inflicted by the new bullet will, probably, be a complete perforation of the joint, in which case occlusion may prove generally serviceable, providing only hemorrhage be not so urgent as to call for more distinct attention, and that shattering of the parts be not so extensive as to demand amputation.

Obviously, the remarks made throughout most of this paper will be seen to concern the ordinary lead bullet, which is yet, and will, for a long time, remain the missile by which harm is done in civil life, and by which many of the gunshot wounds in military life will be inflicted. So far as the new bullets for the Krag-Jorgensen rifle

are concerned, their initial velocity is too great, and their disruptive effect too pronounced to make it likely that they will ever remain in the body unless one be wounded from a very great distance, or unless the bullet has already traversed considerable other solid material. For these bullets, then, one will scarcely ever have to hunt within the human body, and efforts in this direction will scarcely ever be called for.

By the rational method it may be possible to so far locate bullets within the cranium as to indicate, more or less exactly, the point at which they are lodged. Division of special cranial nerves, or loss of special senses, or the now generally understood localizing phenomena, may point to their location here or there; but such studies are, perhaps, of greater theoretical than practical benefit, since it is good practice to trephine all such cases. Nevertheless, the point at which to apply the instrument may, perhaps, be better indicated by a rational study of signs than by mechanical search for missiles.

Under the heading of mechanical means for location of missiles, I would include the use of the various probes which have been suggested, as well as other mechanical devices ever resorted to for this purpose. And, first of all, I want again to insist that the mechanical method is one seldom to be resorted to, and mainly for the following reasons:

As already stated, the bullet has already done its principal harm long before the probe can be used, and that by the act of probing, or other mechanical disturbance, natural blood clot is broken up, the entrance of air permitted, hemorrhage which has spontaneously ceased is often provoked afresh, and, if one may argue from the too frequent abuse of an unnecessary method, it too often happens that the operation is regarded as so simple or trifling that proper precautions are not observed, and that, by a dirty probe or unclean handling of the parts, infection is introduced from without and into concealed recesses which were previously free from it. It is relatively seldom, then, that there is any real justification for the use of the probe, and, usually, there are many reasons why it should not be used. In fact, if ever there be need to do anything at all, there is need to do everything, and we should never be called on to find a bullet until we are prepared to go far at least toward its removal. Aimless probing or mechanical investigation of wounds,

therefore, is not merely useless, but too often harmful. Furthermore, the average medical man who has succeeded off-hand in touching a bullet with the probe seldom has, at that moment, ready the instrumental means for its removal, and he is compelled to do perhaps twice what he need never have done. We need also to emphasize the fact that a gunshot wound is always a gunshot wound, whether it occur on the battle-field or in a street brawl, whether by one's own hand or by the hand of another; and that the dicta concerning gunshot wounds are not those which should be confined to so-called military surgery exclusively.

Since metal bullets became instruments of warfare, and since the time when the barbers, or the barber-surgeons, were those usually called on to officiate in their removal—a removal which the earlier opinions so urgently demanded—the probe, in some shape or other, has been the favorite instrument for their detection. It was a great advance when Nélaton attached to the end of the probe a bead of unglazed porcelain, by which a streak was made upon its dead-white surface when it was moved in contact with the piece of lead. It was Culbertson (Philadelphia Medical Times, April 26, 1873) who suggested the use of meerschaum upon the end of the probe, whose substance should be saturated with a colored solution of ferrid-cyanide of potassium, which would give a blue tint to the white material in case it came in contact with iron, while lead would not be affected by color, but would show the usual streak upon the white stone. Deneux also suggested chemical means in addition to the ordinary probe. He recommended the use of a weak nitric or acetic acid solution, which should be left for a long time in contact with the metal body, and then drawn back with the probe; after which suitable chemical tests would indicate the nature of the metal which had thus been touched. These methods, of course, are not to be resorted to except in the presence of more than the usual conveniences with which the military surgeon is surrounded, and may be regarded rather as curiosities.

Again, we have the *tire-fond* of Baudens, the trochar of Loulaut (1851), the exploratory forceps of Baudry (1862), the ball trephine of Hueter, the tenaculum probe of Baudry, the peculiar probe of Neudoerfer — which contained fine saw teeth, and which, when revolved in contact with the suspected bullet, would bring out fine

dust, indicating the metal — the stilette forceps of Lecomte, and numerous other instruments.

Faure was probably the first to endeavor to utilize the electric current as an indicator of the presence of the bullet. Neudoerfer suggested the use of the thermo-electric pile, which was connected with a probe by one pole, the other pole being connected with an insulated tube, through which the first was passed. The current could only be applied by bringing the two ends close together, yet insulated from each other, in contact with the bullet. Rhumkorff proposed to introduce a galvanometer into the circuit thus made, the probe, consisting of a strip of ivory, having wires passed down on either side of it. This apparatus was modified by Luini, Seseman, Liebreich, and others. Maschek devised a double exploring electric probe, which was used in connection with the induction apparatus. Nélaton resorted to something of the same kind in the celebrated case of Garibaldi. Von Wilde devised an arrangement by which a little bell was rung when the contact was made. This has been modified by Kavacs and others. A very much simplified instrument was suggested by Longmore, consisting of two plates, respectively of copper and of zinc, which could be bound upon the part or could be separated by a weak vinegar solution. With a coil of wire, and with acupuncture needles, and with a pocket compass to act as a galvanometer, it might be possible to indicate a bullet with such simple electrical means.

It has occurred to the writer that in some complicated cases it might be possible to fill the wound with mercury, which would percolate along its complicated passage, and which might come into contact with a bullet, which a probe, even skillfully introduced, might not touch, and that this mercury, acting as a conductor, might permit the electrical connection to be established which would otherwise be impossible. This would be feasible only by a method which compelled the introduction of but one pole into the wound, while the other was applied externally; and even here it might be questionable whether the mercury itself would not give the indication which the bullet alone ought to give.

Another method, which has been resorted to in rare instances, may be called the endoscopic, since for this purpose the ordinary urethral endoscope has been used by Fenger, and, perhaps, by others. This

might be serviceable in a wound already suppurating, where, after cleansing and thoroughly drying, it might be possible, not merely to see a piece of lead, but, by the introduction of suitable instruments through it, to grasp and remove the offending substance. Fenger, however, recommended this rather for fresh wounds than for old ones. His suggestion was tested by Longmore, but without a favorable result.

Finally, we come to the consideration of a method of locating bullets which is relatively very new, because it is based upon the use of instruments which themselves were, but a few years ago, most remarkable and most novel. I refer, of course, to the use of the induction balance and the telephone probe. The use of the induction balance need not long detain us here, since it has been tried and, for the most part, been found wanting. It was introduced by Prof. Hughes, an American electrician, living at the time in London. Its fundamental principle is the variation in strength of induced currents in the presence or proximity of metals outside of their proper construction. Hughes demonstrated his apparatus at the Paris Electrical Exposition, where he claimed for it a possible sphere of influence in surgery. In 1881 the apparatus received a severe test in the sad, but celebrated, case of President Garfield, in which its use was suggested by Graham Bell, who telegraphed to Mr. Preece, the Superintendent of Telegraphs in London, asking him to ascertain from Hughes which particular form he would recommend in this instance. That the apparatus completely failed to render the service expected of it is a matter of history. Although the device has occasionally enabled one to discover small pieces of metal within the tissues, as, for instance, bits of needles in the fingers, etc., it has almost always failed when put to the test in important cases. In at least one instance, however, reported in the New York Medical Journal (August 27, 1887, p. 222), it gave the desired information in a case of gunshot wound of the skull, the bullet being found by trephining at the point where it had been located. Furthermore, in the same journal for September 17, 1887 (p. 323), Girdner has reported six cases, in which the use either of the balance or the telephonic probe permitted the determination and location of metallic masses.

The induction apparatus, however, is so delicate, in some respects so elaborate, and requires for successful manipulation such delicate

maneuvering and such constancy of conditions, that it is impossible that it can ever become generally applicable. Nevertheless, in the hospital, and under certain conditions, it may prove itself of use, at least, as indicating in a general way the location of a bullet. But this, in all probability, would have to be accurately located by some other means.

(See also W. Sachs: Die Magnetnadel als diagnostiches Hilfsmittel in der Chir., Deut. med. Wochenschft, 1891, No. 6. February 5, S. 125.)

In 1887 the telephonic probe, the legitimate outcome of Graham Bell's invention, was demonstrated, February 3, before the New York Academy of Medicine, by Dr. Girdner. (See New York Medical Journal, April 9, 1887, p. 395.) It was at this time hoped that the location of a bullet or piece of metal could be determined more or less accurately by means of the induction balance as a preliminary measure; after which it was proposed to use the telephonic probe for its exact location. Nor, as appears above, have we been absolutely disappointed in this hope, although in almost all instances the combination of instruments has not availed for the desired purpose. In the New York Medical Record of February 4, 1888 (p. 117), there was described an improvement in the apparatus, namely, a sort of handle, which could be easily introduced into the mouth or one of the cavities of the body, which should serve as one pole in completing the telephonic circuit, the final connection to be made when the end of the probe touched the bullet. In the New York Medical Journal for September 17, 1887 (p. 324), were reported instances in which this probe had proven itself of value. In the Kocher Festschrift for 1891 (p. 1), Kaufmann has reported a series of studies, comprising the use of the telephonic device, as well as of various other electrical apparatus intended to perform the same service, including the estimation of the current strength by means of a mirror galvanometer. It is a necessary feature of the telephonic probe that the metal of which it is constructed should be different from that composing the missile which it is intended to find; that is, there must be considerable electrical differences between the two, in order to bring about such variations in current strength as shall make themselves audible in the telephone held to the ear. According to Kaufmann's statement, the arrangement of the instrument, as

sold, is most effective when one endeavors to locate a piece of lead, although it may be used for the detection of iron, copper, or silver. As among the particular advantages which the telephonic probe offers, Kaufmann makes the following claims:

1. The absolutely characteristic sound, which can only be given by contact with metal.

2. The fact that simple contact is enough, without further maneuvering, such as may be required when the Nélaton probe is used, in order to get the characteristic streak of lead upon the porcelain.

3. That a species of acupuncture can be undertaken with this instrument, which can not give the same results in any other way.

4. The fact that bullets, which have been long imbedded, can be recognized as easily as those of recent location.

5. The fact that, in spite of the recent canons of the treatment of gunshot wounds, there are occasional cases where search for the bullet is not merely justifiable, but even urgently called for.

Kaufman believes, then, that the telephonic sound, when it can be used, is the safest, wisest, and best bullet searcher, and that the use of an amalgamated blade, connected with one pole, is an improvement upon the older devices. He has shown, furthermore, that it is not necessary to have a very elaborate apparatus, and that if one only has in his possession a common telephone, one pole may be connected with an ordinary teaspoon, to be inserted in the mouth, and the other with any piece of wire or instrument, which may serve as a surgeon's probe. With the spoon in the mouth, and the wire brought into contact with the bullet, a sound is sure to be heard over the diaphragm of the instrument.

THE LOCATION AND REMOVAL OF MISSILES FROM THE CRANIAL CAVITY.

BY MAJOR GEORGE R. FOWLER, M. D.,
Surgeon Second Brigade, N. G., S. N. Y.

I. THE LOCATION OF MISSILES IN THE CRANIAL CAVITY.

The traumatism of the bullet differs from that arising from any other cause, for the reason that, no matter how slight and apparently simple the injury, the element of concussion always enters into the case, and is to be added to the other existing symptoms. It is impossible to have a bullet injury without this added condition. Further, the concussion caused by fire-arm injuries of the head presents a much greater degree of intensity than can possibly be produced by any other means. The mere fact that the bullet strikes the head is sufficient to give rise to concussion; it need not enter the head or even produce appreciable injury to the cerebral mass. The immediate effects of even spent balls are those of concussion.

The primary symptons of bullet traumatism, therefore, are those of general shock, communicated to the nervous elements. This occurs irrespective of the particular part involved, and independently of the nature and extent of the injury.

The immediate effects of all bullet injuries of the skull, no matter what part of the skull is struck or brain injured, are manifested upon the medulla oblongata. Even without penetration of the skull or injury to the brain substance, in the concussion which follows, the pneumo-gastric center and the respiratory center are at once inhibited or absolutely paralyzed. Those parts of the brain that have well-known localizing functions fail to give any evidence of their specific functions until the general signs of concussion have passed off.

This extraordinarily rapid suspension of the function of the respiratory center is peculiar to gunshot injuries of the head. Its occurrence in connection with any other form of trauma is exceptional. The sudden failure of respiration in cases in which this occurs in comparatively slight injuries, and in severe injuries in which the medulla is not directly or palpably injured, can not be explained in any other way.

It may be said in passing, that there is reason to believe that the prompt application of artificial respiration may restore those functions that are so stupefied, so to speak, as to be incompetent to act intelligently, and that no person should be prononnced dead from a bullet injury to the head, other things being equal, unless artificial respiration has been tried and failed.

To sum up the symptoms which distinguish fire-arm injuries of the head from all other forms of traumatism, these may be stated to be as follows:

1. The extraordinary rapidity with which the function of the respiratory center in the medulla oblongata is inhibited or fails altogether. In the latter case, the suspension of activity of the center is like that of an engine caught "on the center," from which point it can not go without assistance. This is supplied by artificial respiration, which may be successful even after long intervals.

2. The obscuring of every symptom by the prominence of the bulbar signs.

Another effect of the influence of concussion upon the medulla relates to the heart's action, which may be either retarded, as in moderate concussion, in which case cerebral anemia produced by active contraction of the vessel will be present; or accelerated, as in intense concussion caused by severe laceration of brain tissue, and accompanying cerebral hyperemia from paralysis of the vessels and loss of vascular tone.

The secondary symptoms of gunshot wounds of the head are of so varied a character as to be misleading, and they may be positively absent, as shown by the following case admitted to my service at St. Mary's Hospital, Brooklyn.

K. S., aged thirty-two, stood before a mirror, and, taking deliberate aim, shot herself in the left temple with a 44-caliber revolver, just on a line with the top of the ear, and about a half an inch in front of the latter. The ball

passed entirely through the head. She was brought to the hospital twenty-four hours later, perfectly conscious, with the statement from competent witnesses that she had never lost consciousness. She never complained of pain, nor was there, up to the time of her death from encephalitis, forty-eight hours afterward, paralysis of any kind.

The first point to be determined by the surgeon, when called to a gunshot wound of the head, relates to the possibility, when a fracture is found but no evidence of perforation exists, of the ball having passed through the bone between a depressed fragment and the adjoining sound bone, the former spirnging back from its natural elasticity after the missile has passed into the cranial cavity. Surgeons are familiar with the classical case of Von Bergmann, in which but a mere fissure existed at the point of injury; yet, on autopsy, a projectile was found in the brain. This fallacy has been commented upon and cases reported by Koenig, and by Assistant Surgeon Howard, U. S. A. It is more likely to arise in connection with gunshot injuries to the vault than elsewhere. In a case of my own, which entered St. Mary's Hospital, the patient, a would-be-suicide, shot herself in the frontal region, one and a half inches to the right of the inter-parietal, and about two inches in front of the fronto-parietal suture. What, at first glance, seemed to be the entire bullet, was found beneath the scalp in the occipital region, but close inspection revealed the fact that a portion of the lateral surface was missing. A more careful examination of the point at which the ball struck the bone resulted in the discovery of two obliquely diverging fissures, with but a slight depression of the bone between. The trephine was applied just posteriorly to the point of junction of the fissures, and the missing portion of the missile was found, together with an attached portion of the internal table, embedded in the brain substance, within the area of opening furnished by an inch trephine. Other splinters from the internal table were also found, some of which bore lead markings.

Another fallacy consists in the existence of an opening of exit in cases of complete penetration, and still further emphasizes the importance of a close inspection of the bullet, when it is recovered. In this connection an interesting case is reported by Lanphear: *

* Kansas City Medical Index, August, 1888.

A man received a pistol-shot wound of the head, the ball striking one and a half inches to the right of the inter-parietal suture and about two inches posterior to the front-parietal suture. A wound of exit was found at the inter-parietal suture, the longitudinal sinus being injured in the passage of the bullet. The patient died, and the cause of death was found at the autopsy to be a cerebral abscess in the left cerebrum, just above the corpus callosum. The missing fragment of the bullet had passed through the right hemisphere, piercing the falx cerebri. The abscess was located at the point where the bullet was found.

Still greater difficulties may be encountered where the bullet enters from the direction of the cavity of the mouth. Here an immediate search should be made of the vault of the skull for projecting areas of the surface, or evidences of fracture. In this connection an interesting case is related by Gemans:*

A man, aged seventy-seven, shot himself in the mouth, the bullet coursing upward and lodging just to the left of the median line, behind the fronto-parietal suture, where it produced a stellate fracture, and bulging of the bone, plainly to be felt beneath the scalp. An incision was made and the fragments of bone, together with the bullet, removed. Walker† relates the case of a man shot in the mouth, in whom the wound of entrance was found to the left of the median line, behind the hard palate. A puffy swelling was discovered on the top of the head, through which a fracture could be made out. The scalp was turned back at this point, the fractured bone removed, and the bullet found lying beneath some blood-clot and lacerated brain substance.

If no bulging nor other evidences of fracture of vault are obtained, the surgeon will next turn his attention to the possibility of the bullet having lodged in the nasal fossa or one of the accessory sinuses. An interesting case of this kind was admitted to my service at St. Mary's Hospital, in which the patient had placed the muzzle of a small revolver against the hard palate, the bullet lodging in the right nasal fossa, from which it was removed.

The ball may glance off from the bony structures of the base of the skull, or at the back of the pharynx, and lodge finally in the cavity of the mouth, or pass into either the esophagus and be swallowed, or through the glottic opening, and enter into the larynx, trachea, or even the bronchi. In the first instance, the patient may either spit it out or swallow it; if the latter, as well as when it passes

* Pacific Medical Journal, April, 1890.
† British Medical Journal, March 12, 1892.

down the esophagus, it may be passed per rectum. Lodgment in the larynx will give rise at once to symptoms of suffocation, and necessitates immediate tracheotomy. If the ball passes beyond the larynx, if not of too large caliber, it will, probably, by force of gravity, if its projectile force be spent, finally reach the bifurcation, and lodge in one of the bronchi. The angle at which the left bronchus is placed to the trachea will favor its passage in that direction. When the ball reaches the cavity of the mouth by perforating the facial region, broken portions of the alveolar processes, together with detached teeth, may find their way in either of the directions indicated, and yet the bullet itself pass through the base of the skull.

The fallacy arising from the simultaneous reception of other injuries, which subsequently give rise to symptoms of cerebral disturbance, should not be lost sight of. In this connection, the following case is of interest:

E. W., aged thirty-two, was admitted to St. Mary's Hospital, November 30, 1894, with the following history: From early life he had been a "hard case." When a mere boy he was the leader of the "Cherry Hill Gang," and later in life he became one of the most dangerous and expert thieves in New York, attaining the title among his fellows and the police as the "Prince of the Light-fingered Gentry." He was active in the pursuit of his calling until Tuesday afternoon, November 7, 1891, when, in a saloon brawl over election returns, he was shot in the head. The fight was general, but the evidence seems to be pretty clear that W. was lying upon his back, with his face looking toward his assailant, when the shot was fired. The bullet went through the malar bone at its prominence. The hemorrhage was profuse, and an ambulance was summoned, which took him to the Chambers Street Hospital, where he arrived at about 6.30 in the evening. He walked upstairs unaided and undressed himself. At this time his breathing was difficult and obstructive. This grew worse, and Dr. Stimson, hoping to recover the bullet as well as relieve his breathing, did a tracheotomy under an anesthetic. Instead, however, of finding the bullet, the two back upper molars were removed from the trachea. The wound of the face and the track of the bullet were thoroughly explored by Dr. Stimson, but no trace of the missile could be found.

Upon the two days following he was very stupid; this was attributed to the combined effects of the alcohol which he had imbibed, and the anesthetic. Upon the third day, on awakening in the morning and attempting to get out of bed, he found he had no power over the left side; he complained of difficulty of vision; in certain positions he saw double; no trouble with the bladder or rectum. When examined later in the day by Drs. Starr and Walter Vought he was found to be suffering from left hemiplegia and left

facial paralysis. No definite localization of the bullet was made, although it was thought the latter was in or about the inner capsule.

He remained in the Chambers Street Hospital until January, 1892. With the exception of the lower extremity, which improved to the extent of permitting him to go about, there was no change in his symptoms. While it seemed certain that he was suffering from the presence of the bullet in the brain, yet no definite localization could be decided upon.

Six months afterward (May, 1892) he presented himself at the Polyclinic, and was carefully examined by Dr. R. S. Newton, lecturer upon nervous diseases at that institution. He was then found to be suffering from left hemiplegia and left facial paralysis. There was likewise paralysis of the left sixth nerve, and, in addition, *loss of taste*. There were no sensory defects. In commenting upon the case at that time, Dr. Newton propounded the following questions:

1. If the hemiplegia and facial paralysis were due to the same focal lesion, why did the former improve and leave the latter at a standstill?

2. Where, in the brain, could a lesion occur that would produce a hemiplegia, combined with loss of taste?

3. Was the combined loss of taste and sixth-nerve paralysis to be taken as a sign of disease of the pons, or base?

4. Did the facial paralysis, loss of taste, and sixth-nerve paralysis form part of the same process as the hemiplegia?

After careful study of the history and symptoms at this time, it was finally concluded by Dr. Newton that the facial paralysis was due to injury to the nerve, and that it had no connection with the hemiplegia, except in point of time; that the bullet entered the face, passed back, knocking out the teeth, and, meeting the temporal bone, became deflected, and passed across and up over the cavernous sinus to the clinoid process, where it cut out the sixth and seventh nerves. From here it passed up into the white matter of the brain and gave rise to the hemiplegia by pressure. Had the cortex been invaded, other symptoms, including convulsions, would have been present, which up to this time formed no part of the history of the case. Only in this way could be explained the loss of taste, and the location of the bullet be removed from the pons or base.

One year later (May, 1893) he again came under Dr. Newton's observation. His face had improved in the meanwhile so that he could close the left eye. The diplopia from the paralysis of the abducens had passed away. The paralyzed area showed rigid contractions.

One extremely hot day in August, 1893, three months after the last observation and nearly two years following the injury, he was suddenly seized, in Prospect Park, Brooklyn, with his first convulsion, for which he was taken to the Kings County Hospital; he was soon afterward discharged. From this time until October, 1894, he had fourteen convulsions. These always began in the left arm and with movements of the globe, were accompanied by loss of consciousness, and were evidently cortical in origin. It now seemed apparent that the lesion had extended from the white matter to the

cortex above, confirming the opinion previously held by Dr. Newton that the trouble causing the hemiplegia was in the motor convolutions, with facial, gustatory, and eye symptoms, arising from injury, respectively, of the trunks of the seventh (with its small filament to the lingual branch of the fifth) and sixth, or motor oculi externus, these being injured by the passage of the ball.

On December 24, 1894, he was placed under ether, and Dr. Newton marked out upon the shaven scalp a space which should include the top of the Rolandic area, an experience in two previous cases, in which the convulsions had been preceded by conjugate deviation of the eyes, leading him to believe the second frontal convolution, as well as the ascending frontal, to be involved, the area center in these cases being placed higher up than the middle of the Rolandic area, and upon a plane with the leg center in the posterior convolution. At about the middle of the area thus marked out a small scar was now noticed for the first time, thus showing the site of an old scalp wound. I turned back a U-shaped flap of scalp; nothing abnormal in the exposed bone could be found. The trephine pin was placed, as nearly as possible, in the center of the circle which had been marked out, and a one-inch button of bone removed. There was an absence of movements of the dura from cerebral pulsation, which at once attracted the attention of those present. Upon incising the dura a clear fluid escaped from a cyst cavity, the center of which was located beneath the center of the trephine opening. The capacity of this cavity was about a half ounce; it could easily accommodate a large English walnut. The cyst wall was smooth to the touch. An investigation of the neighborhood of the cyst was made by the finger palpating through the cyst wall. At one point, somewhat anteriorly and toward the median line, a point was felt which seemed more resistant to the touch of the finger in the cyst cavity. This was further explored by means of the telephone probe, with a negative result.

As there was no tendency for the cyst wall to collapse, a small drain of iodoform wicking was passed to its most dependent portion, and led out of the wound, the latter being closed except where the drain emerged.

Within forty-eight hours it was evident that the paralysis of the hand had improved; the sense of taste had returned. The drain was removed on the third day, and the scalp wound allowed to close. He persisted in visiting the water closet for a movement of the bowels on the day following the operation. The course of the case was almost uneventful until the night of the ninth day, when, in spite of the application of a casing of plaster of paris, to provide against such a contingency, he removed this and the dressings to scratch his head. Upon the following day an erysipelatous blush appeared at a point where he had displaced the partly-healed flap; this blush extended, septic encephalitis set in, a fungus cerebi displaced the flap, and he died on the following day.

The autopsy was conducted by Dr. Newton, eighteen hours after death, with the following result:

1. Purulent meningitis and encephalitis; fungus cerebi. Cyst wall organized, polished, 1¾ inches deep and from ¾ to 1¼ inches wide, extending through all the layers of the gray matter. No bullet was found in or about the cyst. All other parts of the brain examined, and found to be healthy, save for the encephalitis.

2. The brain was removed and the cranial bones minutely examined for entrance and exit of the bullet. The location of the scar upon the face indicated the original point of passage of the bullet, but no trace of entrance into the cranial cavity could be found. Every portion of bone was most scrupulously scanned, but no trace of the previous injury could be discovered. All the natural foramina were plugged, and the ether and light test applied. All this proved negative; absolutely no evidence of the bullet ever having emerged from or entered the cranial cavity was present.

Gunshot injuries of the facial region, the shot being fired from below and passing through the accessory sinuses, may reach the cranial cavity; or they may stop short of this. In a case occurring in my own practice a boy was shot by a playmate, the bullet entering the antrum of Highmore. It was deflected from its course by impinging upon the lower margin of the orbit, and finally lodged in the spheno-maxillary fossa, where it was located by the telephone probe and removed.

Having positively determined that the bullet has perforated the skull, the next point to determine, if possible, is as to whether or not the dura mater has been perforated. The removal of a button of bone by the trephine, when the vault is involved, or enlargement of the original opening in the bone by the chisel and mallet, or Luers' cutting forceps, after preliminary shaving of a large area of the scalp, and a proper disinfection of the surroundings, should be done preliminary to further search. The bullet may be found resting upon the dura, or between the dura and the inner table of the skull, at the site of the wound, or at a point more or less remote from the original point of entry. This may occur in the case of a spent ball, or one which has lost its projectile force immediately after entering the skull. In this connection an interesting case is related by Saxer.*

A soldier was struck by a musket ball behind and above the left ear. He stated that the surgeons had probed for the ball, but it could not be felt. The wound remained open and suppurating for twenty years, the man com-

* Correnspondenzblatt für schweizer Aertze, Basel, September 15, 1891.

plaining of pain and weight in the side of the head. He was frequently mentally deranged. He died of phthisis forty-three years after the injury. On autopsy the bullet was found to have entered the cranial cavity and to have turned sharply downward, lodging between the dura and the skull. The dura was closely adherent to the bullet; the latter had an irregular bony deposit about it.

The fact that a bullet may be fired from a weapon of good size, penetrate the skull, and yet not pass through the dura, is illustrated by a case reported by Bradford.* The bullet entered the parietal region, passed completely through both tables, made a half revolution upon its bony axis, and was found lying with its butt-end upon the dura; it had not wounded the latter. In this case the bullet could not be found by the probe passed through the opening in the skull, but was discovered after trephining.

The dura mater may be injured by the splintered fragments of the inner table, the latter being driven into the substance of the brain, the bullet assuming an extra dural location. Walker † reports a case of this kind in a suicidal pistol-shot wound of the parietal region. The patient was promptly trephined, and the ball and bone fragments removed. The wound was completely healed in nineteen days, the patient making a good recovery.

The ball may pass but a short distance into the brain substance and be identified by the surgeon's disinfected finger after trephining, the opening in the dura being enlarged for this purpose. Poirier ‡ has reported the case of a boy, aged fourteen, who shot himself in the left temple with a revolver. The skull was freely opened up at the point of entry the same evening, and the finger passed into the lateral ventricle, detected the ball. It was removed, and the boy made a rapid, and, according to the report, complete recovery. In those cases in which the bullet passes but a short distance into the cerebral mass after perforating the skull and dura mater, in which the velocity of the ball has been, to a great extent, lessened by its passage through the outer table, the splintering of the internal table seems to be greater than where the clean "punching" effect of a ball with high velocity is exhibited. Wills ‖ relates the case of a

* Boston Medical and Surgical Journal, December 2, 1891.

† Medical and Surgical Reporter, Philadelphia, August 23, 1890.

‡ Medical Press and Circular, London, July 13, 1892.

‖ Medical Bulletin, Philadelphia, February, 1892.

patient in whom the penetration of the cerebral structures was comparatively slight, but a number of fragments had been driven in and were removed, as well as the ball. The patient, although conscious, was not given an anesthetic. He recovered. In connection with this question the experiments of Delbot and Dagron * upon the conditions found in self-inflicted wounds are of interest. These observers found, in nineteen out of forty-five cases of experimental shot wounds at short range, that splinters of bone were carried in with the ball and scattered in the brain substance.

When both tables are broken the greatest amount of damage is inflicted upon the inner table; this is according to "Teevan's law," that the fracture commences in the line of extension rather than in the line of compression. That this is not due to the greater brittleness of the inner table, as formerly supposed, is shown by the fact that, when the vulnerating force is applied from within, the outer table is the one that is most extensively splintered.

The ball may be found within the dura, and below the point of entry. Lanphear † operated upon a man who was shot one inch to the right of the median line, and one and three-fourths of an inch above the supra-orbital notch. A probe could be introduced three and three-fourth inches without difficulty. He was trephined after twenty-six hours, but the bullet could not be found until the wound in the dura had been enlarged, when it was discovered about three-fourths of an inch below the point of opening.

The question of the direction which the projectile may have taken, in cases of deep penetration of the cerebral mass, should receive careful consideration before attempts at locating the same, either with the finger or the probe, are made. A ball, after passing through the vault of the skull, may lodge, (1) in the substance of one of the hemispheres; (2) it may traverse both hemispheres and lodge at the opposite wall of the skull; (3) it may traverse both hemispheres and, reaching the opposite wall without force enough to penetrate it, turn back and, after a recurrent course of from one to three inches, lodge in the brain substance; (4) it may pass clear through (perforating gunshot injuries). As a further result of the experiments by Delbot and Dagron, above alluded to, it was shown that

* Bulletin de la Société Anatomique, Paris, June 12, 1891.

† Kansas City Medical Index, August, 1888.

the direction of bullets entering the temporal region in suicidal cases may be such as to give rise to motor symptoms. The motor center situated highest and furthest back is more likely to be injured, the ricochet being in that direction.

The probable direction of the ball, as based upon the position in which the fire-arm was held at the time of the shooting, should always be taken into consideration. Likewise, a thorough inspection of the opposite side of the head should be made; for here, as in the case of shots fired from the direction of the cavity of the mouth, a perceptible bulging, or other evidences of a fracture, may be found at a point opposite the wound of entrance. Even the primary course which a ball takes after entering the cavity of the cranium must always remain uncertain, and the difficulties which surround the diagnosis are further enhanced by the fact that the ball may strike the opposite wall, become deflected at a greater or less angle, and finally lodge at a point remote from the line of its original passage. Fluhrer,* in 1884, reported a case in which he made a second trephining at the point of impact against the opposite wall, in order to trace the secondary course of the deflected ball.

In connection with the subject of rebounding missiles from firearms and re-penetration of the brain by these in pursuing a secondary course, it may be observed that Ruth† disagrees with Fluhrer's statement that the bullet may be deflected after passing through the brain and impinging upon the opposite side, and asserts that a ball will only rebound when flattened at least one-third, and that a velocity that will produce this amount of flattening will be almost certain to produce penetration of the skull at the point of impingement. According to this observer, if the ball strikes at right angles to the surface, or within fifteen degrees, and does not penetrate, the ball will be far more likely to lodge at the point of impact, or very near thereto, than to rebound. Repenetration, after striking the opposite wall of the skull occurs, according to Ruth, but rarely, and when deflection does occur, it is almost invariably at angles of more than ninety degrees to the angle of incidence.

The first attempts to search for the bullet in cases of complete penetration, *i. e.*, where both bone and dura have given passage to the

*New York Medical Journal, March 28, 1895.

†Journal of the American Medical Association, August 20, 1892.

ball, will consist of an exploration, by means of the finger, of the lacerated brain substance in the immediate vicinity of the wound in the dura. This may reveal the presence of splinters of bone, even if the ball itself is not located, and lead to the removal of these, and prevent further mischief arising from their presence during the subsequent manipulation. Failing to identify the missile in this manner, the surgeon will at once consider the question of probing the brain. In this manipulation the greatest judgment is necessary, as is also the employment of the most delicate touch. A sharp-pointed instrument should never be employed, nor yet one of the pocket-case probes, which almost always find a place in the every-day emergency equipment of the surgeon. The search should be proceeded with deliberately, and only after full and complete ante-operative precautions of an aseptic character. The probe itself may be of any metal, but of whatever material made it should consist of a spherical or olive-shaped tip, mounted upon a slender shaft, in order to minimize the friction in its contact with the collapsed bullet track, and insure that all the resistance to be appreciated by the hand manipulating the probe is communicated from its tip. The amount of pressure to be employed consistent with safety will necessarily vary with the size and shape of the olive-shaped or spherical tip, the smaller and more wedge-shaped tip easily leaving the bullet-track and passing between adjacent convolutions or into the brain tissues. For this reason the character of the weapon from which the shot was fired should be ascertained, if possible, and its caliber noted, in order that a proper-sized probe-tip may be selected for the particular case. A tip one-quarter inch in diameter will usually answer for any bullet from a 32-caliber up, and a three-sixteenth one will follow the track of a bullet from one of the smaller fire-arms. The amount of force to be employed, within the limits of safety, in propelling a probe along the supposed track of the bullet has been studied by Ruth,* who concludes, as the result of his experience, that a probe tip one-quarter inch in diameter requires from two and a half to three ounces weight to penetrate normal cerebral tissue, and from one and three-fourths to two ounces to cause it to pass between the convolutions. If smaller tips are used the force must be proportionately lessened, but it will rarely be necessary to

* Op. cit.

use a probe of less than three-sixteenths of an inch in diameter, which will require from one to two ounces pressure to penetrate normal brain tissue. The practical application of these experiments of Ruth would consist of either a device whereby the exact pressure in ounces exercised at any time during the manipulation could be seen at a glance, or the preliminary application of weight to the instrument, the surgeon depending upon the force of gravity alone to carry it along the bullet track to the termination of the latter at the site of the missile. The first would involve the use of a coiled spring, which would first receive the pressure, and a graduated index to record the latter.

FIG. 1. The graduated pressure brain probe.

Such an instrument has been constructed at my suggestion by Tiemann & Co., of New York. It consists of a slender stem with an insulating cover of rubber designed to prevent error in locating the missile arising from contact with portions other than the tip. The stem has a bulbous tip, which is designed to follow the track of a bullet from .22 upward. The handle is of hard rubber, is hollow, and slides upon the stem against the pressure of a spiral spring which surrounds the latter. The portion of stem seen projecting beyond the handle is for the attachment of the telephonic probe apparatus. An indicator upon the stem and a scale marked in fractions of an ounce upon the handle records the exact amount of force which is being exerted upon the probe within the limits of the compressibility of the spring. The latter is so arranged that it is within the safe boundaries prescribed as the result of Ruth's experiments. The upper extremity of the handle is made to unscrew for the purpose of cleansing.

The probe is to be used in the horizontal position, in order that the question of weight of the instrument and gearing need not enter into the consideration. The cord attachments connecting it to the telephonic apparatus should be made of aluminum, and be as flexible as possible, in order to avoid embarrassment of the operator's manipulations by the weight or awkward movements of the cord. After trephining the skull and enlarging the opening in the dura,

the tip of the probe is introduced and passed in the supposed direction of the bullet. So long as the pressure made is within the limits of the spring, as shown by the indicator and scale, the probe is in the bullet track. As soon as the tip leaves the path of the missile this will be shown by an amount of force necessary to propel it forward beyond that which is necessary to compress the spring. In other words, as long as the surgeon is making pressure upon the probe with the spring intervening he is within the limits of force necessary to push the tip of the probe into the cerebral tissue, or between the convolutions. As soon as the index shows that the compressibility of the spring has been overcome, or even when the limit of this has been almost reached, the probe is to be withdrawn for a short distance and another attempt made to follow the bullet track. The probe will not leave the latter without first giving warning by means of its indicator and index. Contact with the bullet or fragments thereof will be announced by the characteristic click in the telephonic receiver applied to the ear.

Attempts have been made to locate the exact position of the bullet in its relation to the surface and to indicate the exact point at which a counter opening may be made by the trephine. Morgan's* instrument consists of an inflexible meridian, whose distal pole corresponds to the point of the proposed exit wound when the proximal pole is placed upon a properly introduced searching probe. The trajector is made of a solid bow of steel, in the end of which is a movable rod. The opposite end is arranged so as to adapt itself to any sized probe. A gravity probe is employed, and this is allowed to follow the bullet track until the depth and direction of the latter are ascertained, when it is steadied in position, the trajector placed upon it, and the movable rod pushed along it until it touches the scalp. The proper point for the application of the trephine will be indicated by the point.

Although a white porcelain tip, whose surface is slightly roughened in order to receive the markings of a lead ball, has been in use for many years, this is far inferior to the device known as "the telephone probe," for the introduction of which the profession is indebted to Dr. Girdner, of New York. With the improvement of probes insulated at all parts except the tip, in order to avoid the

*Indiana Medical Journal, September, 1892.

fallacy arising from contact of the shaft instead of the tip, and an arrangement whereby the receiver may be fastened to the head of the surgeon instead of being held in the hand, both of which were suggested by myself in a paper presented at the meeting of the Association of Military Surgeons, held in Chicago, August 8, 9, and 10, 1893, added to the fact that the telephone receiver of Graham Bell is no longer protected by a patent, should lead to the substitution of this instrument for the old porcelain probe in the armamentarium of every surgeon. In the German army the telephone probe is a part of the field equipment of the medical corps.

It has been erroneously supposed that the telephone probe is complicated, and requires a battery for its operation. Nothing could be further from the truth. It simply involves the proper attachment of the connecting wires, and care that these do not come in contact with anything that will produce grating or clicking sounds, which, communicated to the receiver, and thence to the ear of the operator, might interfere with a proper appreciation of the characteristic sound which announces the fact of contact of the probe with a metallic surface in the tissues. This peculiar sound will never be heard when the probe comes in contact with substances other than metal, of whatever nature these latter may be. This sound, once heard, will always be recognized, and can not be mistaken for anything else. No battery is required, and there is no complicated apparatus to get out of order or need adjustment. The principle upon which it is constructed is absolutely correct, and its application simplicity itself.

Finally, search for the bullet by means of a long, slender, blunt needle, passed through the cerebral substance, avoiding the sinus of the dura and the medulla, has been employed, although without success up to the present time. The toleration of the brain to this manipulation has been shown,* but the method involves too much risk for general application.

II. THE REMOVAL OF MISSILES FROM THE CRANIAL CAVITY.

The large majority of those shot in the head upon the field of battle die upon the field, and never come under the surgeon's ob-

* Brooklyn Medical Journal, June, 1888.

servation. This is particularly true of rifle-ball wounds of the head, the immediate mortality from which is very high, and which constitute by far the great majority of cranial fire-arm wounds received in active service. In civil practice pistol-ball wounds predominate, and instant death is not so common but that almost every hospital surgeon, and many engaged in private practice alone, as well, must meet with this class of injuries from time to time.

The large number of cases in which recovery has ensued without operation in bullet wounds of the cranial cavity, particularly in cases of pistol-shot wound, on the one hand, and the generally supposed comparative infrequency of recovery in cases in which operative interference is instituted, on the other, seems to have thrown some doubt upon the justifiability of surgical intervention in this class of cases. Differences of opinion exist, therefore, as to the indications for operative interference other than the turning back of a flap of the scalp and trephining for the purpose of removing splinters of bone and the bullet as well, if within easy reach. Bearing upon this point the studies of Huhn* are of interest. This observer reported 423 cases of foreign bodies in the brain, of which 199 died and 224 recovered. Of the 199 fatal cases, the foreign body was removed in 48; in the remaining 151 cases the foreign body remained in the brain. A larger mortality percentage was found in cases where operative interference was not resorted to, as shown by the following figures:

FATAL CASES,	199
Body removed in	48, or 24.2%
Body not removed in	151, or 75.8%
NON-FATAL CASES,	224
Body removed in	113, or 50.4%
Body not removed	111, or 49.6%

(In these cases the figures in removal and non-removal cases are about equal and give results slightly in favor of removal.)

The mortality differs in different regions of the brain, according to Huhn, as follows: In the anterior cerebrum the mortality was thirty-eight and five-tenths per cent; in the middle cerebrum the mortality was forty-one and five-tenths per cent; in the posterior

* University Medical Magazine, May, 1892.

cerebrum the mortality was forty-three per cent. Foreign bodies in the cerebellum invariably proved fatal.

The above statistics refer to foreign bodies in general. Limiting the inquiry to cases of bullets in the brain, it was found that, of 286 cases, 143 cases recovered and 143 died, a mortality of exactly fifty per cent.

Studies by Huhn directed to the question of the removal of the bullet gave the following result:

NON-FATAL CASES, . .	143	FATAL CASES, ...	143
Bullet removed in .	56, or 39.1%	Bullet removed in .	112, or 78.3%
Bullet not removed,.	87, or 60.9%	Bullet not removed,	31, or 21.7%

Of 168 cases operated upon, including cases in which the bullet was removed, as well as those in which it was not, 112 died and fifty-six recovered, showing a mortality sixty-six and two-thirds per cent. Of 118 cases not operated upon, eighty-seven recovered and thirty-one died, showing a mortality of twenty-six and three-tenths per cent.

Since the introduction of aseptic and antiseptic surgery, sixty cases have been reported, of which twenty-four, or forty per cent, died, and thirty-six, or sixty per cent, recovered. The question of removal or non-removal under aseptic and antiseptic treatment shows a decided gain in favor of the former above the figures previously quoted, as follows: Number of cases occurring in the aseptic and antiseptic era, sixty per cent. Bullet removed in twenty-four cases, with a mortality of sixteen and two-thirds per cent. Bullet not removed in thirty-six cases, with a mortality of fifty-nine and five-ninths per cent.

Huhn further studied the question of the mortality of cerebral abscess following foreign bodies in the brain. These all occurred in pre-antiseptic times, and gave a mortality of ninety-one per cent.

According to Bradford and Smith,* when the bullet perforates (both entering and emerging) or is removed, the mortality is but thirty-three and three-tenths per cent. When it lodges or remains, it is fifty-four per cent.

Commenting on these figures, Bradford and Smith say: "These results are what would be expected, since, generally speaking, these

* Boston Medical and Surgical Journal, October 15, 1891.

bullets are removed by means of the trephine, which have passed but a little way into the brain, the damage to the cerebral substance being slight, and the ease and thoroughness of drainage far greater."

The recent literature of gunshot wounds of the head is replete with instances of so-called recovery, in spite of the presence of the bullet (Somers,† Park,‡ Corniere,|| Mouchot,§ Johnston,¶ Oetman, Jr.,** Wyman,†† Winne,‡‡ Wheaton,|||| Cullon,§§ Googe,¶¶ Drzewiccki,*** and Radojewski, reported by Barry.†††)

The use of the word "recovery" requires a passing notice in connection with those cases in which the missile remained in the cranial cavity, and the patient is reported as recovered. Experience seems to show that, although there may be a subsidence of the symptoms, the presence of a foreign body in the brain must be regarded as a constant menace to the patient. The word "recovery," therefore, in this connection, should be used only with reference to the immediate result following the injury. Cases not uncommonly come under the surgeon's notice which have been previously reported as cured, in which the fallacy of hopes based upon an early subsidence of the symptoms is illustrated. The following case, reported by Colquhoun, ‡‡‡ may be related in illustration:

Four years previously the patient, then a young man of twenty, had shot himself in the head, with suicidal intent. The ball was not removed, and the patient was reported as having made a good recovery. Later on he was subject to epileptiform convulsions, and became fickle, erratic, devoid of self-control, and unfit for work. When seen by Colquhoun he was unconscious, and in convulsions almost constantly. These latter continued with but slight intermissions until he died, three days later. The autopsy showed a ragged and flattened bullet imbedded in the inner table of the

---

† Occidental Medical Times, Sacramento, April, 1892.
‡ Medical News, Philadelphia, December 3, 1893.
|| Bulletin de la Société anatomique, December, 1892.
§ Bulletin de la Société anatomique, February 4, 1893.
¶ Montreal Medical Journal, March, 1893.
** China Medical Missionary Journal, Shanghai, March, 1893.
†† Detroit Emergency Hospital Reports, March, 1893.
‡‡ Northwestern Lancet, St. Paul, Minn., April, 1893.
|||| Northwestern Lancet, St. Paul, Minn., April, 1893.
§§ The Lancet, London, June 24, 1893.
¶¶ Southern Medical Record, Atlanta, Ga., August, 1893.
*** Annual of the Universal Medical Sciences, Vol. III., 1893, Section A, p. 36.
††† Hot Springs Medical Journal, January 15, 1893.
‡‡‡ Gazette des Hôpitaux, Paris, January, 1890.

skull, near the middle line in front, having traversed the brain substance, damaged several of the convolutions, impinging upon the inner table from within aud producing a fracture, as shown by a bony growth and adhesions between the brain, dura mater, and skull at this point.

One of the most remarkable cases in which a foreign body remained in the brain for a long time without giving rise to serious symptoms, in the literature of the subject, is related in the Medical Press Circular for January 18, 1888, as follows:

A man entered the London Hospital, complaining of pain in the head and drowsiness. He died suddenly a few days later, with symptoms of apoplexy. The post-mortem revealed an abscess at the base, inside which a pen holder and nib, measuring nearly three inches in length, was found. The nasal cavities and corresponding eye were carefully examined, but no trace of injury to those parts could be discovered to show the manner of entrance of the foreign body into the cavity of the cranium. The man was thirty-three years old, had been married a number of years, but the widow had never heard him allude to any injury which could account for the presence of the penholder and nib.

At a meeting of the Brooklyn Surgical Society, held February 2, 1888, there was related the case of a lad who had been injured by a missile from a ten or twelve-inch toy cannon. The missile, a stone, was as large as an almond, and entered the cavity of the cranium just above the groove for the right lateral sinus. An exploratory trephining was done the next day, but the foreign body was not found. The operator, in concluding the narration of the case, remarked: "He lived some eight or ten years, and then finally died of tuberculosis of the lung; he made good progress in his studies, and was a bright, active business lad." While it is true that this boy was bright and active, it is also true that he came under my observation not less than three years before his death for Jacksonian epilepsy, but operative interference was declined by the parents. The next information I had concerning him was the announcement of his death, several weeks before, from pulmonary tuberculosis.

In another class of cases the occurrence of symptoms from which apparent recovery takes place, but in which one or more relapses occur, with a final fatal issue, is illustrated in the following cases:

Freelich * relates the case of a student, aged twenty-one, who came under his observation in an unconscious condition, with a revolver wound of the

* Münchener, medicinischer Wochenschrift, August 25, 1891.

right temple. Search for the bullet proved unsuccessful, and he was discharged at the end of three weeks, apparently well, save for loss of vision in the right eye. Nine months after he was attacked with violent pains in the head, and died in coma on the nineteenth day. At the autopsy it was found that the bullet had entered the orbit, tearing away the optic nerve in its passage, and lodged on the under surface of the orbital plate of the frontal bone, where it was found imbedded in a mass of callus. The entire base of the brain, on both sides, medulla oblongata and upper portion of the spinal cord, were bathed in pus; the ventricles were full of purulent fluid.

Battle* reports, among other cases, that of a boy who received a bullet wound of the skull from a small revolver. The wound of entrance was two inches above and one and one-half inches in front of the left auditory meatus. Double optic neuritis occurred, and on the third day an exploratory trephining was done, but the bullet was not found. The neuritis slowly improved until recovery apparently took place, and a fungus cerebri, which had developed in the meanwhile, disappeared. He was kept under observation at the hospital for four months, however, and was then discharged. Four weeks later epileptic seizures came on, and he was readmitted; five weeks later the optic neuritis had again developed. He died about nine months from the time of the injury. The autopsy showed a thick-walled abscess cavity. The bullet was found low down in the right frontal lobe, at some distance from the abscess cavity, and surrounded by apparently healthy, white cerebral tissue. There was no track to show the course the bullet had taken to reach this spot.

In debating the question of the advisability of a thorough search for and removal of missiles from the cranial cavity, the additional damage which this will inflict upon the brain is to be taken into account. The surgeon should bear in mind the fact that, with the exception of cases in which the ball has passed through the brain and lodged in the bone of the opposite wall of the skull from which it has been removed by a counter opening, and those in which it has passed but a short distance into the cerebral tissues and has been found to be readily within reach, as well as those instances where it has lodged between the dura mater and the skull, the location and successful removal of a missile from this region is of rare occurrence. On the other hand, it may be said, as stated by Bradford, that "the general surgical instinct which prompts attempting whatever offers a possibility of success in cases where death seems certain," will favor operative interference, with the view of the removal of the bullet.

---

*British Medical Journal, July 12, 1890.

In any event, there can be no two opinions as to the necessity for, 1. Shaving the scalp far and wide of the opening of entrance, and also that of exit; 2. Scrubbing with a stiff brush and soap and hot water of the entire head; 3. Disinfection of the external parts by means of a mercuric chloride solution, or some trustworthy germicidal antiseptic; 4. Turning back of a flap of scalp to thoroughly expose the wound in order to furnish sufficient room for subsequent manipulation, and to provide for drainage; 5. Enlarging the opening in the dura, which is smaller than the bullet, in order to turn out clots, facilitate the search for and removal of splinters, as well as the bullet itself, and afford drainage to the lacerated brain substance. Further operative treatment, which has the sanction of many practical surgeons of the present day consists in, 6. Making a counter opening in the skull in cases in which the bullet can be traced at a point more or less remote for the purpose of making further search for and removing the bullet, treatment of a fracture, and providing through and through drainage.

In this connection it is interesting to note von Bergmann's* remarkably conservative opinion, in view of the operative boldness which has characterized German surgery since the advent of aseptic and antiseptic wound treatment. He declares that in shot wounds of the skull, the wound should be closed, exactly as in wounds of the knee-joint, and protected against further injury. When no symptoms are present, no operative interference is necessary; but immediate and severe symptoms of irritation, such as contractions, epileptiform convulsions, monoplegia, etc., justify operation. If, however, the symptoms of irritation occur later, trephining is not advised.

Having trephined the skull in such a manner as to include in the trephine opening the wound in the bone, and to afford an opportunity for the removal of the debris from the scalp, hair, etc., and, perhaps wadding from the cartridge, and located the bullet, the latter is to be grasped by some form of forceps and removed. Where the missile lies between the dura and skull this can usually be effected with the thumb forceps, hemostatic forceps, or a curette or small scoop. If it lies in the cerebral substance and can be detected by the finger, these means are also applicable. Where,

* Münchener medicinisch Wochenschrift, June 27, 1893.

however, it lies at a greater depth, some one of the specially designed bullet forceps will be required. Of these, several models are made by the instrument makers; the one best adapted for the purpose is that known as the Tiemann double-jointed bullet forceps (Fig. 2). While, under ordinary circumstances there is no par-

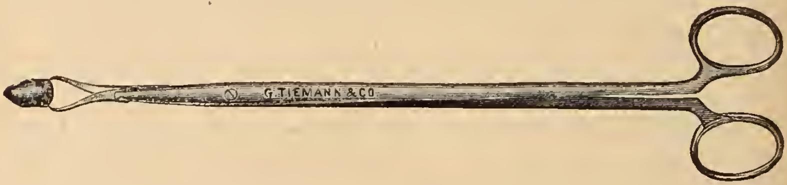


FIG. 2. Showing the comparatively small amount of space required in using the newer patterns of bullet forceps with double joint.

ticular objection to the stretching of the bullet track which the opening of the jaws involves in the use of the ordinary bullet forceps (Fig. 3), this becomes a matter of great importance when

FIG. 3. Showing the increased space necessary, and consequently compression of brain tissue, in extracting a bullet from the brain with the old-fashioned bullet forceps.

the manipulations are made along a track which leads through brain substance. Here every impingment by the forceps upon the wall of the channel made by the bullet may, and generally does, mean fresh injury to the cerebral tissues.

Where the telephone probe apparatus is at hand, the electric bullet extractor, devised by Medical Inspector Wells,* U. S. N., may be employed. This is attached to the connecting wire in place of the probe, and announces, by the characteristic click heard in the receiver when the instrument is in contact with the missile, if the latter be of metal. The special model of bullet extractor, which has been selected for this application of Dr. Girdner's principle by Dr.

*Medical Record, New York, January 5, 1895.

Wells, is such as to permit of its use without the electrical attachment.

While performing the necessary movements in the extraction, these should be as gentle as possible. Rapid withdrawal of the missile is neither necessary nor desirable; a sudden jerk of a ball, roughened by its passage through the rifled bore of a modern firearm, or more or less flattened by its passage through the bone at the wound of entrance or against the bony wall of the opposite side of the skull, may inflict almost if not quite as much damage upon the cerebral tissue in the withdrawal as in its original flight.

While the use of the ordinary mercuric chloride solutions is permissible for purposes of disinfection in all extra-dural injuries, even the weakest solution of this agent, or even carbolic acid, is to be avoided when the cerebral substance is exposed. Adamkiewicz* has shown by experiments upon dogs that the weakest solutions of these (1 to 10,000 of the first and 1-200 of the last named) that would be of any service for the purposes of asepsis or antisepsis, produce deleterious effects upon the brain substance, particularly when this is lacerated. It therefore becomes necessary to substitute either simple sterilized water, a sterilized normal salt solution (6.5 per cent solution, Tavel), or, at the most, a three-per-cent boric acid solution (Adamkiewicz) made with sterilized water, for the stronger irrigating fluids.

The arrest of hemorrhage is of importance in gunshot wounds of the brain—so much so that operative interference is justifiable from this point alone, irrespective of the removal of the missile. In Bradford and Smith's statistics, out of fifty-nine cases death was caused by hemorrhage in ten where no operation was performed, and in but three cases where an attempt was made to remove the bullet. The importance of arresting hemorrhage relates, however, not so much to the threatened loss of life from actual loss of blood, as to those dangers that may arise from increasing pressure of blood poured out within a cavity with unyielding, bony walls. This latter, while it serves to limit the bleeding within the danger point of death from hemorrhage may, from its pressure-effects, increase the shock, and by inducing degenerative or destructive changes in nerve substance, lay the foundation for future mental impairment in cases which otherwise recover.

* Deutsche medicinische Wochenschift, January 12, 1893.

After enlarging the wound in the dura, if any vessels in this structure are found to be bleeding, they may be caught up with hemostatic forceps and ligated. All clots and devitalized tissue having been removed from the bullet track by irrigation and the gentle use of a scoop, the bleeding will frequently be found to have ceased; if not, a tampon of iodoform gauze is to be carefully introduced into the opening in the brain or against the lacerated surface. The amount of gauze which can be introduced without of itself producing pressure symptoms is considerable. The gauze should be applied in the shape of a narrow, continuous strip, which has been doubled in its lengthwise direction with the edges turned in at the middle, and secured by a line of stitching. The object of this is to prevent the strip from fraying and leaving threads of the gauze behind in the brain upon withdrawal of the tampon.

The occurrence of severe and persistent hemorrhage, as shown by the appearance of the blood from the wound through the tampon, or progressive increase in the compression symptoms, may be met by ligature of the carotid artery. Secondary hemorrhage, due to changes in and about the wound arising from septic infection, is to be treated by ligation of the bleeding vessel, or this failing from inaccessibility of the latter, or the impossibility of getting a ligature to hold upon softened tissues, ligation of the external carotid, if the bleeding is from one of its branches, as experience shows that this is a safer operation than ligation of the common carotid, and more effective in controlling the hemorrhage.

Drainage is to be effected by means of strips of gauze while bleeding is in progress, and by soft rubber drainage tubes when there is no hemorrhage. The tube may be made to pass entirely through in those cases in which perforation takes place. Otherwise, its introduction, for a distance of an inch from the wound, in the dura will serve the purposes of drainage.

The external wound is to be closed completely, except at the point where the drainage tube passes out. An aseptic dressing is applied and held in place by a roller bandage, which should include the entire head, particular pains being taken to include the occiput low down; a few turns should pass beneath the chin. The restlessness of the patient will sometimes necessitate the application of a plaster-of-paris bandage over all.

The patient is to be placed at absolute rest and kept upon a light but nutritious diet. Stimulants may be given if absolutely necessary. If a rise of temperature occurs it is probably due either to septic meningitis or infection of the external parts. In case encephalitis develops, and is not controlled by removal of the dressing and careful cleansing, it is recommended to bleed from the jugular vein (Huhn).

EXPERIMENTS ILLUSTRATING THE DEGREES OF POWDER BURN AS MODIFIED BY THE DISTANCE OF THE OBJECT, SIZE AND CONFORMATION OF THE BORE, AMOUNT AND STANDARD OF THE POWDER, AND BY OTHER PRACTICAL DEMONSTRABLE CASES.

By LOUIS A. LA GARDE,
Capt. and Assistant Surgeon, U. S. Army.

The most perplexing question to solve in the beginning of this work was to find a substance to fire into which would give about the same resistance to the penetration of powder as is found in the human skin.

In looking up the literature of this subject I happened upon a very able article by Dr. D. B. N. Fish, in the Boston Medical Journal of October 2, 1884, in which he states that having fired into various substances, like sheep skin, chamois skin, the skin of a young calf, the skin of a living cat, and also upon blotting-paper of various thicknesses, cotton, and woolen cloth, nothing seemed better adapted to him than blotting-paper.

Acting upon the suggestion and experience of this painstaking observer, I concluded to resort to blotting-paper entirely. The paper used was what the dealers style 100, 120, and 140—that is, paper varying in thickness to such an extent that a ream of 480 sheets would weigh 100, 120, or 140 pounds, respectively.

The weapons used were the Springfield rifle, caliber 45; the Springfield carbine, caliber 45; the Krag-Joergensen rifle, caliber 30; Smith and Wesson revolver, caliber 45; Colt's revolver, caliber 45 and 38; British Bull-dog, caliber 44.

The powders employed in the tests were Dupont's F, FF, and Diamond No. 5; Hazard's Kentucky rifle FG, FFG, FGD, and Electric No. 2; of the so-called smokeless powders there were used, the following: American Wood No. 3, Walsrode Leaflet for rifle, and the Peyton.

The results obtained with these weapons and powders are shown in the accompanying table.

Among the more interesting observations to be noted in the table are the following:

The results between "a" and "b," in which all the conditions were similar, with the exception of the length of the barrel of the two weapons, show markedly how this difference alone will influence the degrees of powder burn. The Springfield carbine, having a shorter barrel, consumes less powder in the act of igniting, and the powder grains appear as far as thirteen feet on the blotter. In the case of the Springfield rifle, whose barrel is ten inches longer, the powder is more thoroughly consumed upon igniting, and the powder grains only show up to nine feet.

The difference in the penetration of the powder grains in the blotter—1′ to 3′ for the longer barrel, and 1′ to 4′ for the shorter barrel—may be accounted for in the same way.

The appearance of the powder brand is especially well shown in the result with the carbine, and this is doubtless due to the shorter barrel and greater recoil.

"E" and "f" illustrate the way in which powder stains, burns, or injuries may be modified by the difference in the size of the grains of powder. The coarse powder, FG, of "f," penetrates the paper as far as 4′, whereas the finer powder, FFG, of "e," only penetrates the blotter up to two feet.

The influence of the length of barrel in the case of revolvers is seen in "g" and "h." The powder from the shorter barrel shows stains at 15′, and that from the longer barrel up to 13′ only.

In comparing "k" and "o" it will be seen that the finer powder has penetrated further, which is against the rule heretofore observed. This discrepancy is to be explained by the use of the thinner paper with "o."

The difference in penetration between "k" and "p," which is especially marked, arises from the difference in the grain of the Dupont powders. The great difference in penetration between "m" and "q" is to be accounted for in the same way. The inferior penetration of Dupont's Diamond grain No. 5 is to be accounted for by the fineness of the grain and the fact that it is superior in grade and a quicker powder.

TABLE SHOWING THE DEGREE OF POWDER BURN, AS MODIFIED BY AND STANDARDS OF POWDER, VELOCITY

BLACK POWDERS,

Range.	Weapon and Caliber.	Length of Barrel.	Kind, Amount, and Standard of Powder.	Kind of Shell and Projectile	Substance Fired Into.	Powder Burn as Shown by Ignition or Scorching.
"a" 1′–9′	Springfield Rifle, cal. 45.	32½″	Dupont, 55 grs. FF	Metallic center-fire, cylindro-conoidal leaden bullet. 405 grs.	Blotting paper, medium.	Ignition 2′. Scorching 3′.
"b" 1′–13′	Springfield Carbine, cal. 45.	22″	Dupont, 55 grs. FF	"	"	"
"c" 1′–11′	Springfield Rifle, cal. 45.	32½″	Hazard, 70 grs. Kentucky Rifle. FGD	"	"	"
"d" 1′–12′	Springfield Carbine, cal. 45.	22″	Hazard, 55 grs. Kentucky Rifle. FG	"	"	Ignition 1′. Scorching 2′.
"e" 1′–11′	Smith and Wesson Revolver, cal. 45.	7″	Hazard, 28 grs. Kentucky Rifle. FFG	Metallic center-fire, cylindro-conoidal leaden bullet, 230 grs.	"	Ignition 1′. Scorching 1′.
"f" 1′–13′	"	7″	Hazard, 28 grs. Kentucky Rifle. FG	"	Thin.	"
"g" 1′–15′	Colt's Revolver, cal. 45.	5½″	Dupont, 28 grs. FF	"	"	"
"h" 1′–15′	Smith and Wesson Revolver, cal. 45.	7″	"	"	Medium.	"
"i" 1′–12′	British Bulldog, cal. 44.	2½″	Hazard, 15 grs. Kentucky Rifle. FFG	Metallic center-fire, cylindro-conoidal leaden bullet, 200 grs.	Thin.	No ignition. Scorching 1′.
"k" 1′–15′	"	2½″	Dupont, 15 grs. F	"	Medium.	"

DISTANCE FROM THE OBJECT, CALIBER, LENGTH OF BARREL, KINDS AND DIRECTION OF THE WIND, ETC.

BLACK POWDERS.

Penetration of powder grains	Location of Powder Brand when Present.	Powder Stains and their Location.	Wads, Penetration, etc., Away from Entrance of Projectile.	Lubricant, Penetration, etc., Away from Entrance of Projectile.	Velocity and Direction of Wind.	Remarks.
1′–3′	Above entrance of bullet at 1′ and 3′.	Show above and to the left between 3′ and 7′; irregularly up to 9′.	Shell contained 6 paper wads. 4′–9′	Penetration 2′–5′; still appears on paper at 9′.	3 o'clock, 1–10 miles.	....
1′–1′	"	Above and to the left between 3′ and 7′; irregularly up to 12′.	Shells contained 6 paper wads. 3′–11′	Penetration 3′–5′; still appears on paper at 9′.	3 o'clock, 2–14 miles.	The powder brand is more distinct than that of the Springfield rifle.
"	Above entrance of bullet at 2′ and 3′; distributed around entrance of bullet at 1′.	Above and to the left between 2′ and 5′; irregularly up to 12′.	No wads.	Penetration 1′–3′; still appears on paper at 9′.	3 o'clock, 8–16 miles.	The influence of the wind is especially marked at 2′–12′.
1′–2′.	Above entrance of bullet at 2′; distributed around entrance of bullet at 1′.	Above and to the left between 2′ and 6′; irregularly up to 12′.	"	Penetration 1′; still appears on paper at 9′.	3 o'clock, 3–10 miles.	....
"	Above at 1′ only.	Above and to the left between 2′ and 6′; irregularly up to 11′.	"	No penetration shown; appears on paper between 1′–7′.	3 o'clock, 6–14 miles.	The influence of the wind is especially marked.
1′–4′	Above entrance of bullet at 1′–2′.	Above 1′–2′; irregularly up to 13′.	"	Penetration 1′–2′; still appears on paper at 7′.	3 o'clock, 0–12 miles.	....
1′–3′	Above entrance of bullet at 1′.	Above up to 5′; irregularly up to 15′.	"	Penetration 2′–3′; appears on paper up to 11′	2 o'clock, 1–9 miles.	....
"	"	Above up to 3′; irregularly up to 13′.	"	No lubricant appears on paper.	3 o'clock, 3–12 miles.	....
1′–2′	"	Above up to 4′; irregularly between 5′ and 12′.	"	"	3 o'clock, 1–6 miles.	....
1′–3′	Above and a little to the right at 1′.	Above up to 4′; irregularly between 5′ and 15′.	"	"	8 o'clock, 2–3 miles.	....

TABLE SHOWING THE DEGREE OF POWDER BURN AS MODIFIED BY AND STANDARDS OF POWDER, VELOCITY

BLACK POWDERS.—Continued.

Range.	Weapon and Caliber.	Length of Barrel	Kind, Amount and Standard of Powder.	Kind of Shell and Projectile.	Substance Fired Into.	Powder Burn as Shown by Ignition or Scorching.
"m" 1′–10′	Colt's Revolver, cal. 45.	5½″	Dupont, 18 grs Diamond No. 5.	Metallic center-fire, cylindro-conoidal leaden bullet, 230 grs.	Blotting paper, medium.	Ignition 1′. Scorching 1.′
"n" 1′–7′	Colt's Revolver, cal. 38.	5½″	"	Metallic center-fire, cylindro-conoidal leaden bullet, 155 grs.	"	No ignition. Scorching 1′.
"o" 1′–11′	British Bulldog, cal. 44.	2½″	Dupont, 15 grs. FF	Metallic center-fire, cylindro-conoidal leaden bullet, 200 grs.	Thin.	"
"p" 1′–15′	Smith and Wesson Revolver, cal. 45.	7″	Dupont, 28 grs. F	Metallic center-fire, cylindro-conoidal leaden bullet, 230 grs.	Medium.	Ignition 1′. Scorching 1′.
"q" 1′–15′	Colt's Revolver, cal. 38.	5½″	Dupont, 18 grs. FF	Metallic center-fire, cylindro-conoidal leaden bullet, 155 grs.	"	"
"r" 1′–9′	"	5½″	Hazard, 18 grs. Electric No 2.	"	"	No ignition. Scorching 1′.
			SMOKELESS POWDERS.			
"s" 1′–8′	Colt's Revolver, cal. 45.	5½″	Walsrode Leaflet, 16 grs. (equal in bulk to 28 grs. black powder).	Metallic center-fire, cylindro-conoidal leaden bullet, 230 grs.	"	Ignition 1′. Scorching 1′. The paper and pine backing were both set on fire.
"t" 1′–9′	Smith and Wesson Revolver, cal. 45.	7″	"	"	"	No ignition. Scorching 1′.
"u" 1′–8′	Colt's Revolver, cal. 45.	5½″	American Wood No. 3, 10 grs. (equal in bulk to 28 grs. black powder).	"	"	"
"v" 1′–8′	Smith and Wesson Revolver, cal. 45.	7″	"	"	"	"
"w" 1′–19′	Krag-Jörgensen rifle, cal. 30.	30″	Peyton powder, 37 grs.	Metallic center-fire, steel-jacketed bullet, 230 grs.	"	"

DISTANCE FROM THE OBJECT, CALIBER, LENGTH OF BARREL, KINDS AND DIRECTION OF THE WIND, ETC.

BLACK POWDERS.—Continued.

Penetration of powder grains	Location of Powder Brand when Present.	Powder Stains and their Location.	Wads, Penetration, etc., Away from Entrance of Projectile.	Lubricant, Penetration, etc., Away from Entrance of Projectile.	Velocity and Direction of Wind.	Remarks.
1′–2′	Above at 1′.	Above from 1′-4′; above and to the left between 5′ and 6′; irregularly between 7′–10′.	No wads.	Penetration 1′.	3 o'clock, 6–12 miles.	....
1′	"	Above at 1′-2′: irregularly between 3′–7′.	"	"	3 o'clock, 0–4 miles.	....
1′–5′	"	Above at 1′–5′; irregularly between 6′–11′.	"	No lubricant appears on paper.	No wind.	....
1′–9′	"	Above at 1′–4′; irregularly up to 15′.	"	Penetrates up to 4′.	3 o'clock, 4–8 miles.	....
1′–5′	"	Above at 1′-3′; irregularly up to 15′.	"	No lubricant appears on paper.	3 o'clock, 3–10 miles.	....
1′–5′	"	Above at 1′–7′; irregularly between 7′–9′.	"	"	3 o'clock, 0–3 miles.	....

SMOKELESS POWDERS.

1′–5′	"	Above at 1′–3′; irregularly between 7′–9′.	"	Shows at 2′ only; does not penetrate.	3 o'clock, 1–4 miles.	....
1′–6′	"	Above at 1′–6′; irregularly between 7′–9′.	"	Penetration 1′–4′; appears on paper up to 9′.	3 o'clock, 0–2 miles.	....
1′–3′	Above and to the left at 1′.	Above at 1′–3′; irregularly between 4′–8′.	"	Penetrates up to 3′.	3 o'clock, 0–3 miles.	....
1′–2′	Above at 1′.	Above at 1′–2′; irregularly between 3′–8′.	"	Penetrates up to 3′; appears on paper up to 8′.	3 o'clock, 0–3 miles.	....
1′–15′	None.	1′-19′ Majority of grains below entrance of projectile up to 12′; irregularly distrib'd bet. 13′-19′.	"	No lubricant appears on paper.	3 o'clock, 2–10 miles.	....

The difference in degrees of ignition, penetration, and powder stains between "m" and "n" shows the influence of varying caliber when the same kind of powder is employed.

Of the so-called smokeless powders, only three kinds were tested—the Walsrode Leaflet for rifles, American Wood No. 3, and the Peyton—the latter is used at present in the Krag-Joergensen rifle, which was lately adopted by the United States Army. The composition of these powders is unknown, except to the manufacturers, and it is therefore impossible to give a correct description of them. The Walsrode consists of little square scales about the color of common glue; the American Wood powder is a body consisting of grains about the size of mustard seeds, brownish-black in color; the Peyton powder consists of prisms about the size of No. 8 shot and about the color of lead shot.

The powder brand appears very distinctly with the Walsrode and American Wood powders. The powder stain from these two gives a bluish discoloration to the paper, which disappears for the most part at 3′, although some grains may be seen as far as 9′ with Walsrode and 8′ with the American Wood.

The most remarkable departure from the well-known effects of powder at close range will be noted with the Peyton smokeless powder. If we examine the results opposite "w" we find that this powder causes neither ignition nor scorching of the paper at 1′; that it penetrates the blotters all the way from 1′ to 15′; that it produces no powder burn, and, therefore, no powder brand. The powder grains indent the paper as far as nineteen feet.

One of the noticeable differences noted between the effects of this and all other powders on the blotter is this, the majority of the powder grains from 1′ to 12′ entered the blotter below a line drawn horizontally through the orifice of entrance of the projectile.

Subsequent experiments have shown that this powder will penetrate three thicknesses of medium blotting-paper at one foot, when these are placed one behind the other at touching distance; and that at touching distance from the muzzle it only produces the faintest discoloration of the blotter. The color of the paper is greyish for only two inches about the entrance of the projectile.

When the muzzle is held against cotton-wool no ignition occurs upon discharge of the weapon.

Since this powder shows no powder brand, we will be at a loss in many instances henceforth to account for the position in which the weapon was held at the moment of firing in homicides and suicides. The medico-legal value of this point will, therefore, become obliterated. This will be especially true if the Peyton, or similar powders, should be employed in revolvers.

The value of the powder brand was first brought out by Dr. Fish, in the article already quoted. He describes the brand as follows: He says: "I notice, in addition to the smutting of the paper by smoke, and to the marks of the partly burned and the unburned grains of powder distributed around the bullet hole, one spot, blacker and more burned than the rest. I found this was caused by the flame of the gases, by the burning powder, and by the residue or ash of the burned powder striking and resting in this place. I also noticed that this burned and blackened spot held a most constant position, directly above, or above and a little to one side of the bullet hole."

Although Dr. Fish gives a correct explanation of the position of the powder brand which always occurs on the hammer side of the weapon; that is, if the weapon is held hammer to the left, the powder brand will appear to the left of the bullet hole; if the hammer is held down, the powder brand will be below, and if it be held to the right the powder brand will be to the right; yet the explanation of Dr. J. N. Ball, of Denver, in the Boston Medical and Surgical Journal, August 14, 1890, is more to the point. He states that "the point of support of the weapon being below the line of application of the force generated by the burning powder, this force tends to cause the weapon to revolve about the point of support. The gases which impel the ball, being necessarily behind, follow the new direction of the barrel after the ball has left it, and hence strike above the bullet hole, or to one side or below, as the case may be."

In concluding this paper I have to state that it is a very difficult matter to ascertain correctly the degrees of powder burn as modified by the distance of the object, size and conformation of the bore, amount and standard of the powder, etc., because of the factors which are apt to influence the results differently with the same weapon and ammunition at different times. Among these factors may be mentioned the influence of the wind, the temperature and

moisture of the air, and also the condition of the weapon as to cleanliness, and also whether the powder is packed tightly or otherwise in the shell. Observers have noticed that even when all the conditions were as similar as they could be found, still there was a slight difference in the degrees of powder burn.

Under such circumstances we are forced to admit that no invariable rule can be established that will be a guide for determining beforehand the different degrees of powder burn. The best that one can do in a given case is to repeat the firing by experiment, and then his results must only be assumed to be approximate to those in the point at issue.

EXPERIMENTS WITH THE NEW UNITED STATES (KRAG-JORGENSEN) ARMY RIFLE—PROTECTION OF THE SOLDIER.

By Ex-Brig.-Gen. J. D. Griffith, N. G. M., Kansas City, Mo.

Professor of Surgery, Kansas City Medical College, etc.

Mr. President and Gentlemen :

In my report of experiments made to you in 1893, in Chicago, the conclusion was reached that the new Springfield rifle was anything but a humane weapon at the distance of 800 yards or less, and that at 1,000 yards or more its explosive effects were slight.

On September 1, 1894, accompanied by Brig-Gen. Moore, Lieut.-Col. Pearson, Major Geo. Halley, and Capt. J. N. Jackson, the last two being Surgeon and Assistant Surgeon, respectively, in the Third Regiment, also Drs. H. E. Pearse, Geo. O. Coffin, Langsdale, Newton McVey, Wm. T. Stark, and several other gentlemen, I caused a second series of experiments to be made on the range at Ft. Leavenworth, Kas. I had at my disposal the rifle and ammunition furnished by Adj.-Gen. J. A. Wickham, of Missouri.

The day was gusty, the wind blowing nearly diagonally across the flight of the missiles. It took considerable firing to obtain the range at the distance of 1,000 yards. I might say, while on the subject, that the range was gotten by placing a second target about eight feet to the windward, and aiming at this.

The following is the result of missiles fired into a cadaver of a full grown man at the several distances mentioned therein :

Shot No. 1. Struck the left leg just to the left of the patella, making a clean cut through, passing out at a point opposite and behind. Wound of entrance and that of exit the same in appearance. No difference in the size of these two wounds.

No. 2. Struck in the left side of abdomen, in the hypochondriac region, passing out just above the sacrum. Wound of entrance and that of exit both small and clean cut and of the same size.

No. 3. Struck the center of the abdomen just below the umbilicus. Passed clear through and out through the lumbar vertebra. Wounds of entrance and exit the same.

No. 4. Struck the abdomen on the right side in the region of the liver. Passed out through the right side, posteriorly.

No. 5. Struck the abdomen just below the border of the ribs on the left side, passing clean through.

The cadaver was now moved up a distance of 500 yards and about four feet is allowed for windage.

No. 6. Struck in the left thoracic region, passing through and out one and a half inches to the left of the vertebral column.

No. 7. Struck the left side of the abdomen in the region of the descending colon, passing through and out.

No. 8. Passed through the ulna at the junction of the middle and lower third. Wounds of entrance and exit in the skin here appear the same.

No. 9. Passed through the lower abdomen in the center line and out through the sacrum. Seemingly this shot passed through the bladder.

The gun is now changed to 350 yards.

Nos. 10, 11, and 12. Passed through the chest in and around the sternum and out at similar points behind. Wounds of entrance and of exit appear the same.

Nos. 13, 14, and 15. Struck the abdomen all to the left of the median line and out correspondingly.

No. 16. Struck the head in the very center over the nose, and passed out behind, at the junction of the parietal and occipital bones.

All of the wounds of exit at the different ranges of 1,000, 500, and 350 yards presented very much the same appearance. This was simply a puncture the size of, or a very little larger than, the bullet, and perfectly clean cut as far as could be seen. (Fig. 1.)

Wounds at the different ranges were marked by plugs of different color at the time of each shot. The cadaver (presenting the appearance seen in the accompanying illustration) was now taken down and post-mortemed by Drs. Pearse and McVey.

FIG. 1. Photograph of Cadaver.

It was noticed at the post-mortem that in wounds of 1,000 yards, where the gut was perforated, these perforations varied from one-half to one inch in diameter. It is but fair to say that at the time of injury of these small intestines they were partly filled with fluid or semi-fluid contents, as their escape could be noticed at the time of placing the pegs.

No wound of less than a half-inch in diameter was found in the intestines where the range had been 500 yards.

The mesenteric wounds were all from one and a half to two and a half inches in their rents. The one going through the sacrum at its third joint, a little to the left of the median line, fractured this entire bone in all directions, splintering it completely.

The 500-yard wound, which passed through the spleen, as per illustration, showed a very ragged tear from one and a half to two inches in diameter. The wound of exit was at least two and a half inches, splitting the spleen.

One of the 500-yard bullets passing close to and grazing the kidney, tore its capsule for a distance of one and a quarter inches, severing, as if by a knife, the large vessels, as shown by the illustration herewith attached.

One 500-yard bullet passed through the left chest, fracturing the rib in three longitudinal shivers, and making a tear in the left lung one and a half inches in diameter. The ball passed through the lower lobe of the left lung after fracturing the rib, forming an opening the size of the diameter of the rib; rib was much comminuted; the posterior chest wall somewhat torn, and the wound of exit was the same size as that of entrance, which was the size of the ball.

Another 500-yard bullet passed through the sternum, with some comminution of bone, just to the right of the median line, through the right auricle of the heart, making wounds of entrance and exit one and one-half inches in diameter, and the right ventricle making wounds of entrance and exit about one-half inch in diameter, piercing the thoracic aorta, making wounds one-half inch in diameter, clean cut, passing through the posterior wall, causing a comminuted fracture of the rib, and leaving the wound of exit from the body the same size as the bullet. A 1,000-yard bullet caused a wound of the knee-joint, the wound of entrance the same size as that of exit. There was no damage to the cancellated structure beyond the track

of the bullet. A wound of the ulna, at a distance of 1,000 yards, completely fractured and comminuted it for a distance of one and a half inches on either side, as shown by the accompanying illustration. (Fig. 2.)

A wound of the skull, at 350 yards, one-half inch above the nasal notche. Ball passed through the anterior, middle, and posterior lobes of the brain, making exit from the skull one and a half inches posterior and to the left of the mastoid process, as shown per illustration. Wound of entrance in the skin and outer table, same size as the ball. The inner table opposite this point extensively fractured. Stellate in character. Brain on this side completely disorganized. (Fig. 4.) Longitudinal fracture of the skull extending from the wound of entrance to the junction of the lambdoidal and sagital sutures. Fracture also from the wound of exit, through the posterior superior angle of the left parietal bone, to the middle of the right parietal eminence. Wound of exit in the skull three-quarters of an inch in diameter, and very badly splintered. (Fig. 5.)

I found a great many of the bullets just behind the cadaver in loose earth, buried only from two to four inches, occasionally finding one on top of the ground. This led us to the inquiry as to *why* should we find these bullets in this position. On commencing to investigate the penetrating quality on earth-works, old and new, we here show you, by illustration, a bullet dug from old earth-works, a distance of at least thirty-six inches from the surface, without the slightest deformation. (Fig. 6.) And now firing into rapidly made "Pickett" earth-works, I found that it was impossible to penetrate loose earth-works more than eighteen inches, accompanied with complete upsetting of the ball, as seen by this illustration. (Fig. 13.) Not a single ball penetrated beyond eighteen inches of loose earth at any distance from 500 yards down to thirty yards.

On April 6, 1895, accompanied by the same gentlemen, in part, and by Dr. Turrill, U. S. A., of Ft. Riley, I made the third series of experiments at the same place. The cadaver used in these experiments being that of a younger and smaller person than the first mentioned. The day was gusty, and it was only after considerable practice that the range was acquired. The following are the notes of the firing:

No. 1. 600 yards. Struck in the left lumbar region. Wound of entrance and exit each from one-half inch to one inch in diameter.

FIG. 2. Photograph of 1 Spleen, 2 Kidney, and 3 Ulna.

FIG. 3. A—Position of Skull Wound, Shot No. 8.

FIG. 4. Wound of Entrance in Bone.

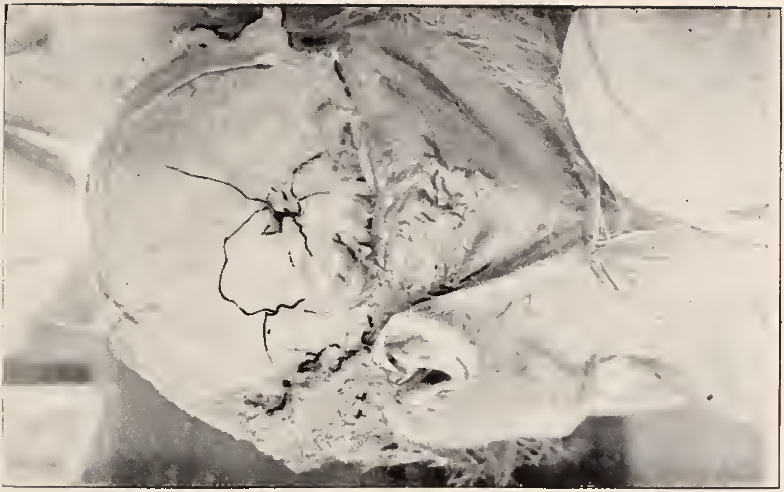


FIG. 5. Wound of Exit in Skull.

FIG. 6. Bullet Found in Old Earth.

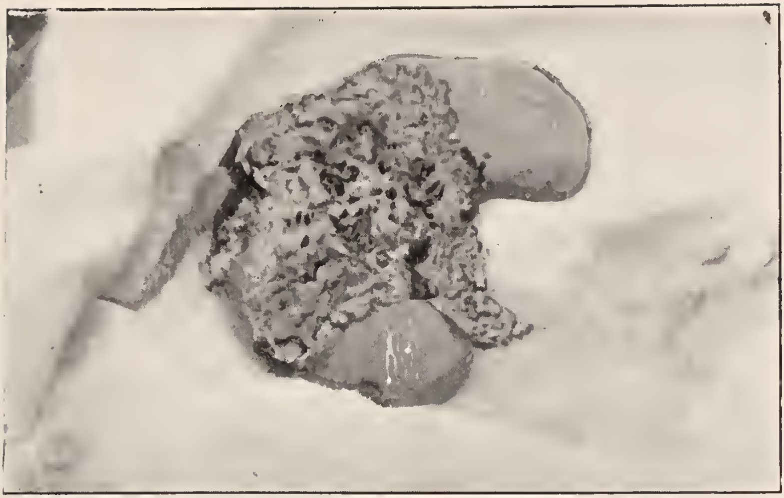


FIG. 7. Wound of Kidney—Shot No. 1.

FIG. 8. Position of Wounds in Arm, Hip, and Abdomen.

Kidney torn one-half inch in length. Wound of entrance in kidney same as that of wound of exit. Passed out one and a half inches to the left of the spinal column, leaving the exit from the skin the same size as that of the bullet. (Fig. 7.)

No. 2. Wound made at the same range in the left iliac region one inch to the left of the anterior spine. Entered the abdominal cavity, perforating the sigmoid flexure of the colon. Wounds of entrance and exit the same, one-half inch in diameter. Bullet passed out at the posterior margin of the ilium, one inch external to the sacro-iliac symphysis, making a stellate fracture of the ilium, reaching up to the crest and inwards to the symphysis; the wound of exit in the skin same as wound of entrance.

No. 3. 600 yards. Wound in the right iliac region. Entered one inch above the right anterior spine, did not enter the abdominal cavity. Struck the ilium on the inner edge of the crest, two inches back of the anterior spine, comminuting the ilium. Wound of entrance three-quarters of an inch in diameter. Ball passed through the ilium, leaving a bridge of bone one-third of an inch wide and one-eighth of an inch thick, unbroken along the edge of the crest of the ilium. Wound of exit from the skin the size of the ball.

No. 4. 600 yards. Bullet struck the right fore-arm about the middle, passing between the radius and the ulna without injuring the bone or any large blood vessels. There was no severe laceration of tissue. Wounds of entrance and exit and the track of the bullet all about the size of the bullet. (Fig. 8.)

No. 5. 600 yards. Struck the hand. Wound of entrance the size of the ball. Passed between the two extensor tendons of the hand without wounding either. Bullet passed through the head of the radius. Wound of entrance in the dorsal surface of the radius the size of the ball, one-half inch from the articulation of the wrist. Styloid process not fractured. Wound of exit produced a stellate fracture on the under surface of the radius, extending upward two inches. Cancellated structure pulverized.

No. 6. Wound of the chest at 1,000 yards. Wound of entrance to the left of the sternum, in the second intercostal space, one-half inch to the left of the median line. Passed through the sternum to the left of the trachea, and above the arch of the aorta. Wound of exit one-half inch to the right of the second dorsal vertebra. No fractured bones. No damage to the vital parts or organs.

No. 7. Wound at 1,000 yards. Struck the right clavicle at the junction of the outer and middle thirds. By this bullet wound about one inch of the clavicle was destroyed, being finely comminuted. (Fig. 9.)

No. 8. Wound of the skull at 500 yards. Bullet struck the forehead at the lower angle of the right orbit. Wound of entrance in the skin size of the bullet, while that in the skull was considerably larger. The skull was terribly fractured in all directions around the opening. The bullet passed directly through, making absolutely no ricochet, and completely pulverizing all of the contents of the right side of the cranial cavity (Fig. 10), making a wound of exit in the lower portion of the occipital bone somewhat larger than the bullet, and in the skin about the same size as the bullet. Fractures extended in several directions from the wound of exit and, in fact, this complete half of the skull was mutilated. This wound was one of unusual interest, as will be noticed by the accompanying illustration. (Fig. 11.)

In firing into twelve-inch square tin cans filled with water, at a distance of 500 yards, I found that the Springfield rifle bullet would enter the can, expand its explosive force on the other three sides of the can other than the side of entrance by bulging it, but would not come out on the opposite. I found that at the same distance the new rifle ball would penetrate the can completely, coming out on the opposite side, deforming the can most markedly, but the bullets in either case were not markedly deformed. In using the wet sand in the same size cans I got about the same amount of deformity of the can itself, due to the explosive quality of the balls, but neither of them would penetrate. The steel plate, as shown by the illustration, was perforated by every one of the new bullets that struck it a distance of 500 yards, but not so with the old gun. As seen by the illustration, the perforations were each very much larger than the ball. (Fig. 12.)

The firing into loose earth hillocks twenty to twenty-five inches at base, at all distances, only went to sustain the fact that a soldier could protect himself in ten minutes, with his bayonet, from bullets from the new gun, as each and every one of them lodged in the "Pickett" hillock, no perforation taking place where there was twenty-four inches thickness. It is very easy to demonstrate, contrary to the ideas of Stiles and Brunner (by actual field service), that the

FIG. 9. Wound No. 7—Right Clavicle.

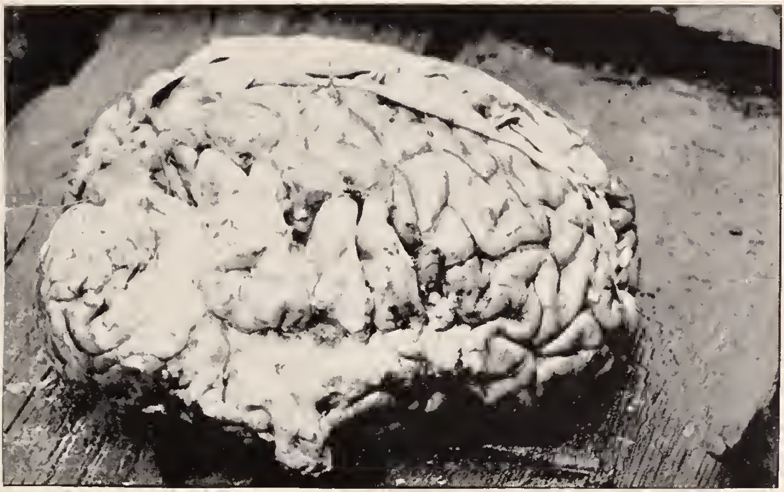


FIG. 10. Wound of Brain Substance.

FIG. 12. Steel Plates, $\frac{3}{16}$-inch Perforation.

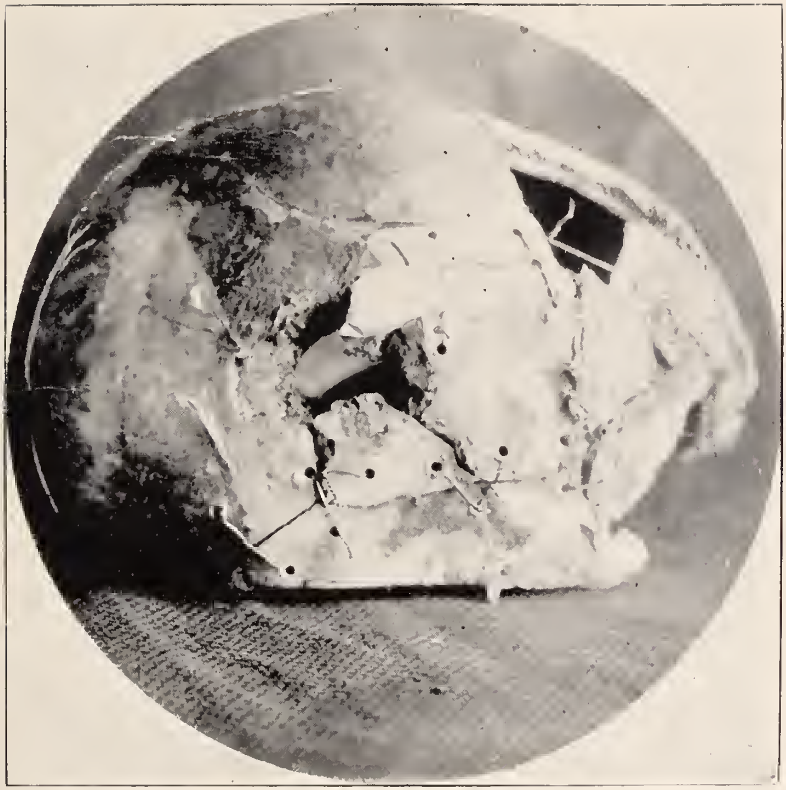


FIG. 11. Fractured Wound of Exit in Skull.

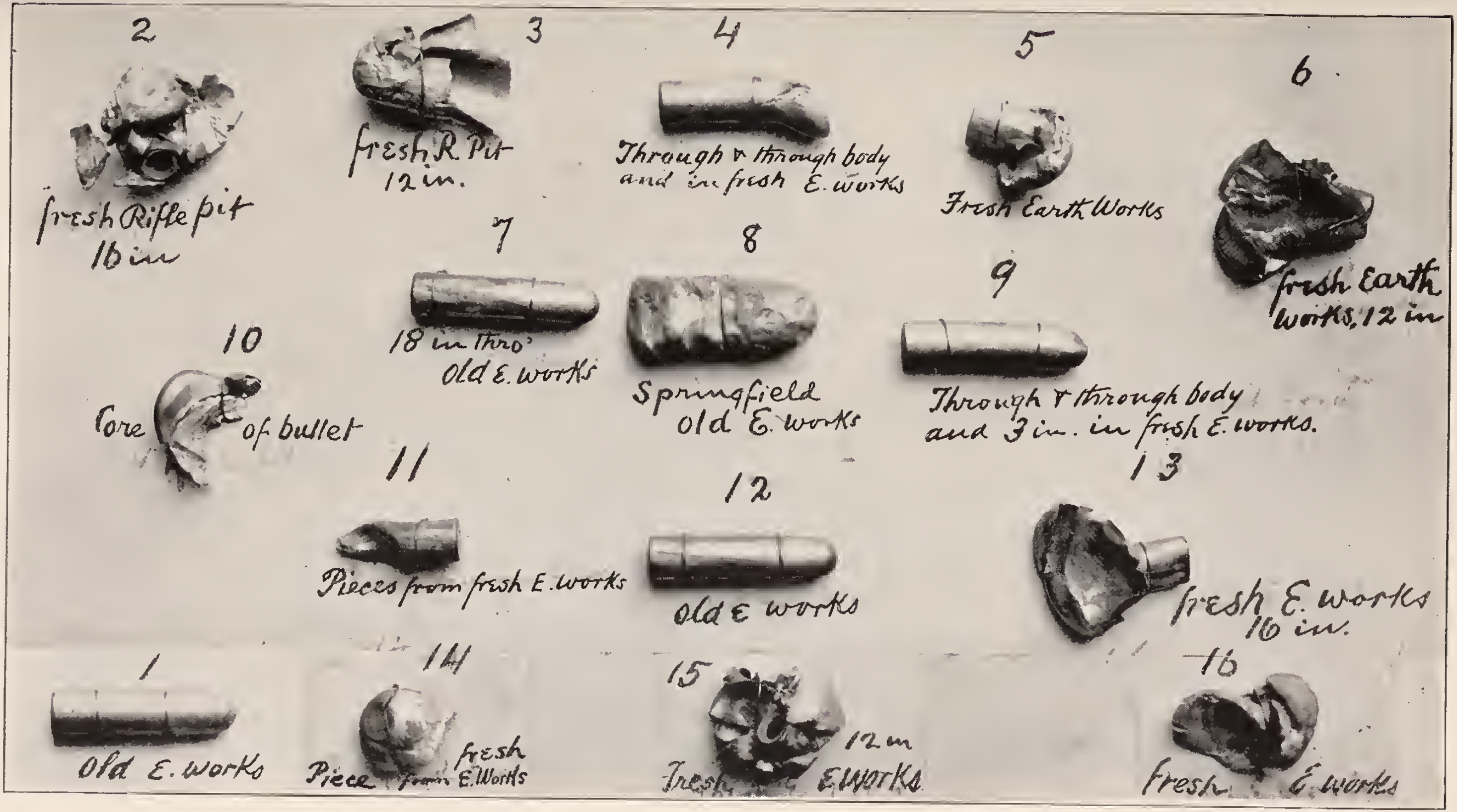

2
fresh Rifle pit
16 in
3
fresh R. Pit
12 in.
4
Through & through body
and in fresh E. works
5
Fresh Earth Works
6
fresh Earth
works, 12 in
7
18 in thro'
Old E. works
8
Springfield
old E. works
9
Through & through body
and 3 in. in fresh E. works.
10
Core of bullet
11
Pieces from fresh E. works
12
old E works
13
fresh E. works
16 in.
1
Old E. works
14
Piece from fresh E. Works
15
Fresh E. Works 12 in
16
Fresh E. works

FIG. 13.

soldier in battles of the future can protect himself most thoroughly from this most dreadful weapon.

Lieut. Stiles, in a lengthy discussion before the 8th Cavalry Lyceum, of South Dakota, on the merits and demerits of the new gun as compared with the old arm now in use, gives a very minute and accurate description of the wounds produced by the new bullet in all of the zones. In the 4th zone (over 2,000 yards), he says: "The new bullet loses a little of its favorable character, and extensive splintering and comminution again appear."

As regards the vital organs, he says that the heart, if struck when its cavities are filled, will have the results of the explosive action of the bullets. *This I found most emphatically in the cadaver.* The lung tissue, he states, is never severely lacerated by the explosive action, but that the wound here bleeds profusely, being clean cut, and that the wound is extremely hard to find, being so small that it closes rapidly, hence it must be a very dangerous one, to say the least. This I found just the reverse.

But in trying to prove the superiority of the new rifle, he endeavors to bring out facts concerning its use in actual warfare to this end. He speaks of its *increased range and accuracy*, causing a battle to begin earlier and at a greater distance, stating that the men will be longer under fire.

According to this writer one is led to believe that the rapid firing, the increased supply of ammunition, and the smokeless powder, will all go for naught, as the men will begin firing at so much greater distance that correct aim will be impossible, and consequently a large amount of ammunition will only go to waste, such hits as are made being purely accidental. In future battles armies will be as close as ever, and no unusual amount of ammunition will be wasted.

It is also stated in Lieut. Stiles' paper that in Capt. La Garde's report, of all shots striking bone under *200 yards*, the German silver mantle was ruptured and separated from the bullet in ten per cent. This I did not find the case. Lieut. Stiles says: "I believe that Tailor Dowe would find his armor useless against such a ball. It is this lack of *homogeneity* in the bullet that enables the hard steel wire, or plates in the jute body of his cuirass, to rupture the mantle of the *Manlicher bullet* and distort and overcome the velocity of the

lead core that the relatively thin layer of jute and metal are able to bring it to a standstill." No plate or protection can be worn by the soldiers against this bullet. He speaks of the dangers of ricochet hits, alleging that contact with *any hard substance* is certain to split the mantle. He declares that *brick or stone walls*, *field trenches*, and *earth-works* are *pierced* at close range, and fire concentrated on particular points will produce regular breaches. (Fig. 13.)

He thinks that, inasmuch as the new ball will not lodge in the body under 1,200 yards (in the first and second zones), that there will be less need of surgical operations, especially upon the abdominal cavity; and yet he admits that there are likely to be many abdominal wounds, owing to the large proportional surface of the abdomen, even though he remarks of the dangers of this class of wounds. Our field surgeons will have to be on hand, and at once, to save the wounded from the intense shock and severe hemorrhage. Dr. La Garde, in some of his most remarkably interesting and instructive experiments, speaks of the heat of the ball not being sufficient to sterilize it. I found quite a number of these balls after going through the body and into the solid earth behind, which, when dug out, could not be handled with any degree of comfort.

I think with Brunner, "Nobody will maintain that firing at close quarters will be rare in future wars. In decisive struggles the opponents will often shoot at one another at much less range than the short shooting distance of 500 meters. Fortified positions, farm houses, and villages will often have to be carried by fighting at close quarters. Sudden nocturnal surprises will also not be wanting, especially in mountain warfare. Just imagine the effect of magazine fire, then, on closed columns! Owing to the tremendous penetrative power of the small-bore bullets cover will have to be used more extensively than hitherto."—*U. S. Service Gazette.*

I insert as a part of this report communications from Maj. George Halley, Dr. H. E. Pearse, and Brig.-Gen. Moore, in the order named, who aided me in the experiments named herein.

DR. J. D. GRIFFITH, CITY:

Sir—The wounds that were made in the body by the new weapon at a 1,000-yard range were, first: In the bones; there were two of these, I believe, at this range—one in the condyle of the femur and one in the middle of the ulna. They were very different in character. The bullet evidently

retained the position it was in when leaving the barrel of the gun. The hole made in the condyle of the femur was a smooth, clean cut, and very much such a hole as would have been made by a drill or an auger. Bone was not shattered or splintered, and the point of exit looked a good deal like the point of entrance. It was, in all particulars, an ideal wound. The wound in the ulna, however, was very different. The bone here was completely broken at the point where the ball went through, and reduced to fragments precisely as is done with the old gun. The point of exit was ragged and terribly torn; the bullet in passing through crushed the bone into numerous fragments.

The wounds made in the spleen, intestines, kidneys, and heart were exactly similar to the wounds that I have seen made by the old-style weapons. The spleen was torn up so that the wounded portion could have been made to lap half way around the arm. The end of the kidney was split open and mangled extensively. The wound in the heart was a very large, ragged one, and would have been as destructive to life as any I have ever seen made by the old bullet.

The openings in the intestines were clean, sharp cuts, and would have allowed immediate extravasation of the contents of the alimentary canal. In this respect these wounds would have been more deadly than those made by the old bullet. These latter wounds were made at a distance of 500 and 350 yards, respectively; the wound in the head was made, I believe, from the 350-yard range, the point of entrance was near the median line of the forehead, and a little above the level of the roof of the orbit. The entrance opening in the bone was not very large, scarcely admitting the tip of the little finger. The point of exit, however, in the occipital bone was much larger and quite ragged, the fragments of bone being broken up and thrown out, so that the aperture would admit the entrance of the point of the index finger readily. In a radiant manner from the point of exit were a number of lines of fracture in the skull, some extending down into the base, others across the occipital bone, altogether, I believe, five distinct fractures. On removing the calivarium the substance of the hemispheres through which the bullet passed presented a good deal the same appearance the spleen did, fully carrying out the statements made by Mr. Victor Horseley, of London, who experimented extensively with these bullets. It was, all in all, quite as deadly a wound as would have been made by the old Springfield bullet.

The bullet, while thus making exceedingly deadly wounds in the soft tissue, failed to penetrate any considerable depth of dry, loose earth, If the object is to get a weapon more deadly than the one now in use, eminent success seems to have attended the effort. The bullet does not appear to have weight enough to carry it through loose earth.

A soldier will be practically safe behind an embankment of from thirty to thirty-six inches of loose earth, providing it was dry.

Respectfully submitted,

[Signed,] GEORGE HALLEY,

Maj.-Surg., 3d Regiment, M. N. G.

DR. J. D. GRIFFITH, CITY:

Sir—I beg leave to submit a report of my observation regarding the effect of the shots fired by the new army rifle in the course of your experiments at Ft. Leavenworth, Kas., April 6, 1895.

Regarding the perforation of the targets, the most noticeable thing, probably, was the uniformity with which the bullets from the new gun penetrated the various substances. I think that I am correct in stating that every bullet that struck the steel plate passed directly through it, while in the case of the leaden balls penetration appeared to vary, some penetrating and others only denting.

The most remarkable fact was the small amount of damage done to the bullet itself in passing through substance other than steel; for instance, in perforating the interrupted sand and wood targets, which consisted of seven boards, each one inch in thickness and one and a half apart, and the interspaces packed with sand, making an aggregate of seven inches of wood and about nine inches of sand, the bullets penetrated this without key-holing or deviating from their course, and made an opening of exit but little larger than that of entrance. A number of these were found after they had passed through the target, and careful comparison with one that had never been fired failed to show any impairment of the integrity of the bullet. However, when the bullets struck the steel plate they did not perforate them with a small hole, but caused a large, irregular opening, very similar to that caused by the lead missile. This is perhaps due to the fact that the balls are badly broken up by their contact with the steel plate, so that the hole seems to have been made through the steel plate not by a conical steel bullet but by a mass of metal, resulting from the destruction of that bullet upon the face of the steel, and carried through the steel by its own momentum.

As to its effects upon the organic tissues, I have the honor to state that I conducted post-mortems upon bodies wounded by this gun, and a report of the same is found in the stenographer's field notes, now in your possession. The only noticeable points aside from what are mentioned in this report are, first: That when striking a capsulated organ, such as the brain, spleen, liver, and kidneys, at a range of less than a thousand yards, terrible damage is done from the explosive quality of the bullet; second, wounds of exit made by the ball are almost universally the same size as wounds of entrance. This does not pertain to those occasional conditious in which fragments of tissue have been driven out, thereby enlarging the wound of exit.

While it is true that the ball penetrates almost everything with which it comes in coutact, deviating but slightly, uot being deflected by curved surfaces of bone which it strikes, generally passing through a vessel rather than pushing it aside, I would call your attention to a certain wound of the wrist (mentioned in the field notes) made at a range of 600 yards, in which the extensor tendous of the hand were not injured, although the bullet passed between them, severing their sheaths and pushing the tendons aside.

Other points, perhaps not spoken of in the field notes, are the large amount of destruction of cancellated bone, and the absence of sound made

by the bullets striking the human body. (This is especially noticeable as compared with the sound made by the bullets from the old Springfied rifle.) Third, the difficulty in locating the marksman by the report of this gun; the new rifle causes a sharp "crack," not nearly so easily located as the "bang" of the old Springfield rifle.

It was certainly my impression in watching the firing done April 6, that the same marksman, under the same unfavorable conditions, did very much better shooting with the new gun than with the old Springfield rifle with which they were more familiar. The greatest drawback in the rapid handling of the gun seemed to lie, as suggested by Lieut. Penrose, in the fact that the stock and trigger guard must be released by the right hand in order to grasp the bolt which operates the ejector.

It would also be interesting to know whether this gun thus used in the rain, for the firing of nearly 400 rounds of ammunition, and being given only such care as the soldiers could give them in the field, would be in as good working order the next morning as our present Springfield rifle under the same conditions. Submitting these notes for your kind consideration, I have the honor to remain,

Very truly and sincerely yours,

[Signed,] H. E. PEARSE, M. D.

I may say here that the gun was clean and the barrel was perfectly bright the next day, and absolutely no care taken of it.

DR. J. D. GRIFFITH, CITY:

Sir—At the experiments made under your direction on the range at Ft. Leavenworth, Kas., September 1, 1894, and April 6, 1895, with the new Springfield — commonly known as the Krag-Jorgensen — rifle, I gave my attention wholly to the effect of missiles upon loose and compact earth and loose sand.

On the first-named date the target employed was placed in front of a parapet that had been used as a butt by the troops at Ft. Leavenworth during the season of target practice of 1894 and before. Its face was thoroughly *ploughed* with rifle balls of large caliber, and as firing had been done when the earth was damp, the outer surface of the butt was, to some extent, broken into small lumps or clods and very dry.

Firing had been in progress for quite a time when one of your party, Dr. Pearse, discovered a ball in the dust on the face of the butt. This caused an examination for missiles, which resulted in finding many; some were scarcely buried in the loose soil while others had penetrated but a few inches. As no measurements were taken the depth of penetration can not be given exactly.

Firing was had at 350 and 500 yards. Balls fired at the distances last mentioned were recovered, and there seemed but little difference in the degrees of penetration of balls fired at the several distances mentioned. Of the

missiles fonnd, some were flattened latterly, others bore traces of the rifling of the piece, while still others were nnmarked. One was discovered with a part of the point cnt out. I am satisfied that this missile had struck a nail in the scaffolding snpporting the target.

A shallow excavation was made and the earth was thrown np in front to represent a hastily constructed rifle pit. The monnd of earth so formed was of a diameter of twenty-five inches at its base. Five shots were fired at this at a distance of twenty-five paces. Three striking the top passed throngh, but two entering the mound near the base did not. The two bnllets were not recovered; in fact, not even examined for. None of ns then knew the effect produced upon balls fired into loose earth at short distances.

The face of the parapet was cnt down to damp and one shot fired at it, at a distance of twenty-five paces, which penetrated eighteen inches and was recovered uninjnred.

On April 6 the principal tests, as on September 1 preceding, were made upon a cadaver, but ten shots were fired at a hillock of loose, comparatively damp earth, with a base thirty-fonr inches in diameter, at a distance of 100 yards; also, a like nnmber of shots were fired at a hillock of loose Missouri River sand of same size and at the same distance. The entire ten shots fired into the monnd of earth were recovered. All were practically torn into fragments; the penetration was eighteen inches and less. Of the shots fired at the sand hillock five were recovered, several having passed throngh near the top. The shells of two of these recovered were bnrst, the others flattened latterly to some extent, bnt not materially misshapen; the greatest penetration was abont twenty inches. I nse the term *about* for the reason that the sides of the monnds were sloping and the point of entrance of each separate missile conld not be definitely determined, owing to the fact that the particles of sand moved upon slight agitation.

The tests of April 6 were made during a down-ponr of rain, and for that reason was not as thorongh as might have been nnder more favorable circnmstances.

Why loose earth shonld be more destrnctive to the missiles fired from the new rifle than loose sand I am nnable to assign a reason. The snbject is one of great interest, and I shonld be glad to witness fnrther experimentation npon loose and compact earth.

Judging, however, from the tests above referred to, I am of the opinion that twenty-five inches of loose dry earth and thirty inches of loose damp earth will afford adeqnate protection to the soldier against the missiles of the new rifle fired at a distance greater than twenty-five yards.

Very respectfnlly,

[Signed,] MILTON MOORE,

Brig.-Gen., M. N. G.

CONCLUSIONS.

1. Battles of the future will not be fought at artilleristic range.

2. Any soldier can protect himself by the use of his bayonet as a pick.

3. The best protection is loose dry earth; the next best, loose sand.

4. At distances up to 1,000 yards the explosive quality of the missile is terrific.

5. This explosive quality is most marked in soft tissues and cavities — the brain and lung tissues are terribly torn and the heart burst.

6. When a viscus is grazed by a bullet it is much mutilated.

7. Vessels are cut, not torn; hence, death rate on the field will be very great. Four killed to one wounded (probably).

8. Tendons are the only tissues in the body which seemed to be turned aside by the ball.

NOTE ON THE VALUE OF BROMINE IN MILITARY SURGERY.

By M. O. TERRY, Surgeon-General, N. G. N. Y.

The valuable remedy to which I shall direct your attention is one not of recent discovery, for so far back as 1826 M. Balard, of Montpellier, in the bittern of sea-salt works, found it associated as bromide of magnesium. For its preparation we will refer you to the dispensatory.

We find it recommended for a number of chronic diseases, but we will confine our observations to conditions which have to do with camp and field.

As an antigermicide, bromine *1 to 875* will prevent the *reproduction of spores* in boiled meat infusion; *1 to 5397* will prevent *development of spores; 1 to 336* will prevent the *reproduction* of *developed bacteria; 1 to 2550* will kill bacteria; *1 to 769* will prevent the reproduction of *undeveloped bacteria.* (Brunton-Pharmacology.)

Bromine was used during the war, and was written up especially by Medical-Director M. Goldsmith, U. S. V. In the Medical and Surgical History of the War of the Rebellion, Part III, Surgical Volume, can be found the article which deals principally with the effects of bromine in gangrene. (See page 834.)

In preparing bromine for use the following directions were given, and the solution was made as follows: Bromine, one Troy ounce; bromide of potassium, 160 grains; distilled water, enough to make four fluid ounces of the entire mixture. At the same time printed directions for its use were issued, as follows:

1. *For Fumigation.*—Place vessels containing one ounce of the solution at different points of the ward, and in number sufficient to secure in the latter the constant presence of the odor of bromine. It should be borne in mind that if the vapor of bromine comes in contact with the vapor of water, hydro-bromic acid is formed; there-

fore, when there is much of the vapor of water disengaged in the apartment the quantity of the vapor of bromine must be correspondingly increased.

2. *Topical Applications of the Vapor.*—A piece of the dry lint is to be placed over the diseased part; over this is to be another piece of lint *moistened with the solution of bromine*; over this a third piece, *spread with simple cerate;* the whole to be covered with oiled silk and bandaged, so arranged as to retain the vapor in contact with the diseased surface as long as possible. The solution is to be renewed as often as it becomes exhausted by evaporation.

3. *The Solution, in Substance, as a Direct Application in Hospital Gangrene, Diphtheria, Gangrene of the Tongue, and Other Diseases of this Nature.*— The parts are first to be dried by the application of charpie; then the sloughs, if thick, should be trimmed out with forceps and scissors as much as possible, for the thinner the slough the more effective is the remedy. The parts having again been dried, the solution is applied by means of a mop or pointed stick o wood, in quantity sufficient to saturate the sloughs. If the sloughs undermine the skin or dip down into the intermuscular spaces, the solution must be made to follow with the pointed stick, or by means of a glass syringe with a long nozzle. If the application has been effectual all odor from the diseased surface ceases and the slough becomes somewhat hardened. The remedy should be reapplied every second hour as long as any odor of putrefaction is present, or as long as the sloughs appear to be diffluent. It is not always necessary, especially when the sloughs are diffluent and thin, to use the solution in its full strength; it may be weakened by the addition of water as the disease subsides.

The points to be especially attended to in the use of the solution of bromine, are two: 1. The solution should be applied in strength and frequency sufficient for the impregnation of the *whole of the sloughs.* 2. To secure this end the application *should be made by the surgeon himself*, and never be trusted to a nurse. If the sloughs are thick and can not well be trimmed the bromine may be introduced into the thickness of the slough by means of a hypodermic syringe. After the topical application of the solution the parts, when so situated as to render it practicable, should be so subjected to the influence of the vapor. (See No. 1.) Surgeons will do well

to bear in mind that bromine is a new remedy for the purposes indicated above. The directions for its use given here are those followed in the military hospitals of this city; it may be found advisable to modify them as experience with the remedy accumulates. It is, therefore, earnestly recommended that the subject be studied diligently, that the effects of the remedy be carefully weighed, and that the application be varied as new facts are developed in its use.

Surgeon Thomson has stated in his report in reference to the action of bromine, expressly in hospital gangrene: "The action of bromine is that of a caustic; all of the necrosed tissues are converted into tough yellow shreds, and are perfectly deodorized. The ulceration seems to be checked at once, while the nervous system, no longer depressed by the absorption of the fetid products of the mortification, soon recovers from its depression. The areola looses its livid hue, becomes more crimson, and finally disappears; the sloughs are rapidly thrown off, and a rosy, florid surface appears beneath. The bromine was also used in the form of vapor, confined to the surface by oiled silk. Its antiseptic influence is very powerful, since not the least odor could be perceived on dressing these gangrenous sores, even when they have been covered closely with oiled silk for twelve hours. From its antidotal efficacy in these two cases I have formed a high opinion of its value in the local treatment of this disease."

Surgeon Cleveland states, among other things: "Nearly every day I have had either cuts, pricks, scratches, or other abrasions on my hands, which are freely exposed in dressing the wounds and in the dead-house, with no unpleasant consequences. I have always applied bromine to the denuded surfaces before exposure, and am convinced that the virus of the dead-house, as well as other animal poisons, is entirely destroyed by the action of bromine."

The above has been quoted to show, in the first instance, the method of using bromine during the late war, how imperfectly it was understood, and the limitation of its use. I confess I have not had extensive experience in the use of bromine in gangrene, but statistics show that scarcely 2.6 per cent of cases have been lost by its use as against 38.4 and 51.5 per cent by other methods.

The object in bringing this remedy before you more particularly has been for the purpose of directing your attention to its applica-

tion in a variety of septic conditions heretofore not entirely satisfactorily treated. I have been making observations in the use of this remedy for many years, and have been so astonished at its results that I am surprised that it has not been more generally adopted for a variety of conditions of this character. Surely difficulties, such as dissecting wounds or cuts of all sorts by poisonous instruments, injuries made by a rusty nail, suppurative wounds, especially of joints with sinuses, and phlegmonous inflammations, are questions of sufficient moment to attract the attention of the surgeon, and have a marked bearing on the surgery connected with the militia.

In the preparation of bromine for use I have formulated the following prescription, from which I have made weaker preparations:

Bromine, ...	2 drachms
Pot. Bromide or Iodide, ...	2 "
Aqua, ...	1 pint

Marked 1–64.

For all poisonous wounds, as those caused by rusty nails, bite of a dog, etc., the first dressing should be made from the solution marked 1 to 64. Subsequent dressings, 1 to 240. As the inflammation subsides, the heat and pain disappearing from these wounds, the strength of the application of the bromine should be decreased to 480, and even weaker.

In the case of an injury of the knee, resulting in suppuration, sinous openings having formed, I should wash out the openings with 1 to 240, using the same application externally. Such difficulties, which continue all the way from three weeks to many months, I have seen recover within one week after having continued by other methods of treatment for weeks.

In the case of phlegmonous erysipelas — now comparatively rare since the introduction of antiseptic methods—following amputations, the application of bromine, 1 to 240, keeping the parts constantly wet, will rapidly reduce the septic inflammation without any other measures.

In the case of the surgeon who had inoculated himself in the index finger of the right hand and middle finger of the left, after cauterizing with the crystal solution of carbolic acid and nitrate of silver without improvement, suppuration still continuing, the pain

and swelling increasing, an application of bromine to the finger, it being inserted into a glass containing a weak solution of the bromine, gave immediate relief and suppuration rapidly disappeared.

Tetanus, which may proceed from the rusty nail, bruises, and various injuries, the danger of which is caused by the irritation of nerves coming in contact with the injury, may be prevented by the early application of bromine in an emulsion with oil to reduce the septic inflammation. The oil, being a relaxant, prevents contraction, and, therefore, reflexed irritation resulting in tetanus.

In rhus toxicodindron, or ivy poison, it has given relief when bicarbonate of soda and carbolic acid and other vaunted remedies have failed.

The various difficulties I have referred to, wherever bromine has given satisfactory results, are liable to be met with by the surgeon in camp and field. Should diphtheria break out among the troops the value of this remedy is incalculable. Dr. Testé, of Paris, France, has spoken with positiveness in regard to its value in this difficulty, and asserts that "nothing is more simple in the treatment of diphtheria and croup than bromine water; *i. e.*, distilled water containing 1 to 100 of its weight of pure bromine, of which he administered from one to three drops in a teaspoonful of sweetened water every hour, reducing the frequency of the doses as amelioration sets in." He says he "can count by hundreds the cures obtained by a means so simple."

The great volatility of bromine makes it particularly useful as a deodorant and an atmospheric disinfectant. In wards, therefore, where many surgical cases are placed together, the evaporation of this remedy, I believe, will insure safety and prevent contamination of other patients. The influence of this remedy in that respect was noted during the late war.

In preparing for operations, a weak solution of bromine, to which is added carbonate or bicarbonate of soda for its saponifying effects, I more frequently use than any other antiseptic. Unlike bichloride of mercury, no danger from absorption need be apprehended.

Its internal administration is not to be lost sight of in septic conditions. Taking the preparation 1 to 64, one to three drops, largely diluted in water, may be taken every three or six hours.

I have simply given a few practical points in reference to bromine.

Seekers after truth can take the thread and carry it onward, developing the uses of this invaluable remedy in other channels.

As it will be observed, the underlying principle in reference to the use of bromine is whether the difficulty is *septic* or *not*. A comprehension of this feature of the remedy will make it invaluable to the surgeon for a multitude of difficulties not within the scope of this paper.

DETAILS REGARDING THE MEDICAL SERVICE OF THE NEW YORK NATIONAL GUARD DURING THE BUFFALO STRIKES IN 1892.

By Lewis Balch, Major and Surgeon, N. G. N. Y.

At 7 o'clock of the morning of Thursday, August 18, 1892, orders were issued to repair at once to the armory, as the 10th Battalion, N. Y. N. G., of Albany, was ordered to Buffalo, where serious riots and strikes were in progress. With one day's rations and sixty rounds of ammunition, the command moved from its quarters in time to take a special train at 10 o'clock, three hours after the call, and was joined at the station by the 6th and 21st, separate companies of Troy. At Amsterdam the 46th, and at Utica the 44th, separate companies, joined, making a total of eight companies, with almost 560 men present for duty. While *en route*, details for officer of the day and guard duty were made. A few minutes after 8 o'clock in the evening we detrained at the Wagner car shops, Seneca Street crossing, in Buffalo. Being met here by staff officers sent by Gen. Doyle, commanding the 4th Brigade, Major Stackpole, of the 10th Battalion, was told by the commanding officer to guard our line of tracks, and shortly after our arrival the guard marched out and sentries were posted. We had almost three miles to cover, and ninety-seven posts were found necessary, which gave extra work to the men, the command not being large enough to give full reliefs without doubling sentry duty.

First Lieuts. and Asst.-Surgs. Hyland, of the 46th, Dye of the 44th, Seymour of the 6th, and Houston of the 21st, reported to me as the senior medical officer present. We took possession of a shed for a temporay hospital and put in it one of the men who was taken with a convulsion, but a heavy rain coming on we had to find other quarters, as the roof leaked, and in a short time the place was untenable.

Friday morning a room that had been used as a supply store, having over it another that could be used as a ward, was taken by the commanding officer at half-past six, and hospital quarters for the sick established there. The hospital steward of the 10th Battalion not having reported, he being away from home ill when the order to move came, a private from Company A of the battalion was detailed as acting steward, he being a practical druggist, and in addition, two others were detailed as hospital attendants. The quarters soon assumed shape, and lacked only patients to make them appear in full harmony with their outfit. There being four assistant surgeons, it was arranged that each, in order of rank, should be what may be termed the medical officer-of-the-day, although all were required to be present at sick-call, after which, the one detailed for the day took charge of the patients, and any that might report after the morning call. Had the command become engaged, stations were prescribed for each surgeon and litter bearers were provided for. Fortunately, this contingency did not arise. We were also notified that the hospitals of Buffalo were at our disposal, and that ambulances could be called by telephone.

The published accounts of the progress of the strike, before orders were issued for the mobilization of troops in Buffalo, led all in the service to expect a call for duty, and the hospital knapsack, which was in the armory of the 10th Battalion, was examined to see that its contents were fit for use before we left Albany. The other companies serving with us did not have any means for carrying medicines and dressings; so, consequently, this knapsack had to serve for all until we could add to our stores by purchase.

On Sunday, the 21st, Gen. Bryant, then Surgeon-General, inspected all the camps, and asked what was needed to insure proper attention to any sick and wounded. The sanitary condition of each post was looked into by him, and some general arrangements made for the conduct of the medical work. Among others, in order to aid and relieve Major Park, the Surgeon of the 4th Brigade, he having some private patients he could not leave, Gen. Bryant detailed the senior medical officers to brigade headquarters, each taking one day's duty as Acting Medical Director. This not only helped Major Park, but was excellent training for the ones so detailed. My turn came on Monday, the 22d, and reporting early

in the morning to Lieut.-Col. Clifton, A. A. G., I was told to do whatever I thought was necessary for the better organization of the medical service.

As blanks for consolidated and morning sick reports had been received that day from general headquarters, these were first issued to the post surgeons of the different camps. Requisitions for medical stores coming in in an irregular fashion and calling for every conceivable remedy, on the 23d I proposed to Major Park that he issue a medical supply table, showing what articles (and in what quantities) could be drawn, and submitted a draft of such a table, with instructions how to use it, which, with the assistance of the Assistant Surgeon of the 6th, separate, Lieut. Seymour, I had prepared the day before. Major Park thought well of the suggestion, and, adopting the draft presented, had it printed and issued. A copy of this circular is attached.

On the afternoon of Monday, in company with Major Park, I made an inspection of as many camps as could be reached before night fell. Mr. Voorhees, the General Superintendent of the N. Y. C. R. R., kindly placed his private engine at our disposal for this work. At all the posts visited the medical officers were found thoroughly equal to the emergency they were called on to meet. Knowledge and appreciation of camp hygiene was shown. The attention to the location and care of sinks evidenced intelligent understanding of what was necessary. At one camp not visited by us, that of the 12th Regiment, and known as "Camp 1," Major Henry, then Surgeon of the command, had to devise a system of surface drainage in order to make the ground habitable. One regiment, the 23d, had a medical chest containing all the medicines and dressings necessary for a week's service. This was the only command I know that was so well fitted out.

At Camp No. 12, where the command to which I was attached was quartered, the sanitary arrangements were excellent. In the yard in front of the main shop some little draining had to be done. Mr. Voorhees had a bath-house constructed around one of the hydrants in the yard, between the tracks, fitted with two big wooden tubs, giving the men a chance to have a comfortable bath, of which they were not slow to avail themselves. The sinks used by this command were latrines built at one end of the large shop in which

the companies quartered. It was in a separate building, though under the same roof, two walls separating it from the general room. While more latrines would have been better, the ones we had, with the aid of a hose and seeing that the drain was kept thoroughly clear, did very well. The railroad company furnished men to police them, and they were kept clean, no nuisance being experienced.

Our men slept on straw placed in cribs on the floor of the large shop. Each crib held a company, and between them tables with benches were built. Peddlers and citizens, other than the road's employes were, by order of Lieut.-Col. Fitch, who assumed command on Sunday, excluded.

In such service as this strike duty the commissariat is always, at first, hard pushed to provide adequate rations. It is no easy matter to feed six to seven thousand men with but a few hours' notice. Add to this the difficulty of distributing rations, cooked and ready for the table, for camp equipage was not issued to the Guard in 1892, and it is little wonder that the first day or so the meals were not all that could be wished and were not served on time. But there was plenty to eat, and the post commissaries made arrangements for messing the men of their camps, thus relieving the central department of a great labor and at the same time giving better satisfaction to the men. At one post we cooked our rations, in large part, ourselves; stoves and camp equipage, with stores and, in short, anything that was needed, being promptly furnished on requisition. All food, both raw and cooked, was inspected by the medical officer. In my report to Gen. Bryant, of the tour of duty, I stated the character of the rations issued, and now quote from that report: "The rations consisted of hash, oat meal, roast beef, corned beef, roast mutton, beef tongue, potatoes, vegetable soups, cabbage, pork, beans, soft bread, butter, crackers, pies, coffee, milk, sugar, salt, pepper, and pickles. Onions were also issued, being cooked in the hash and soup." Men should not complain of such rations when in active service, and ought not to get sick, except from over-eating, when quality and quantity are taken into account. We certainly had nothing to complain of, and much to be thankful for.

The consolidated sick report of Major Park shows for eight days a total sick of 170, the greatest number on any one day being on the

fourth of the tour, when thirty-four were reported as relieved from duty on account of sickness. When it is understood that 7,169 men were present in Buffalo under arms, doing unaccustomed duty, having to stand rain without a change of clothes, the wonderfully small sick list is most gratifying. It speaks well for the men, the commissariat, and the care and judgment of commanding officers.

The tour of duty taught the medical officers a great deal. While the system of rigid examinations of candidates for a commission in the medical staff of the N. Y. Guard insures doctors who are well informed in their profession, it is one thing to be able to handle patients when the advantages of home and nursing can be had, and when a near-by apothecary can put up any prescription the exigencies of the case may require or the fancy of the attendant dictate, but it is another matter for these same physicians, well equipped mentally as they are, to suddenly assume the position of a military surgeon, without any hospital, or medicine chest, or case of instruments, or trained nurse, or aseptic dressings, or any of the dozen or more things we all consider needful in private practice. Proof of this was shown in the requisitions for stores that came pouring into headquarters. When on such service as this strike duty the medical officer is expected to get along almost with what the old Scotchman called the "twa samples, collomy an jollapy." I believe a too elaborate outfit is apt to increase the sick-list for the men, at least a great many of them like to be treated, and the surgeons do not seem adverse to trying how the convenient medicine chest works.

As an outcome of the experience gained in Buffalo, Gen. Porter had formulated a ration list, with instructions how to purchase, and also caused each command to be fitted out with necessary camp and cooking utensils. And Gen. Bryant, from his observations, devised a supply table for medical stores, and had the old hospital knapsacks replaced by the modern hospital pouches, these carrying sufficient to meet all calls for the first few days, and during that time requisitions can be forwarded and supplies rapidly received, for the supply table tells how much of any article can be drawn, and all the brigade surgeon has to do, if he is the officer designated to furnish the supplies, is to arrange with some drug house to have a number of packages of each article ready for issue as soon as called for. Gen. Bryant further recommended the adoption of a

medical chest somewhat similar to the army pattern, but especially arranged for our service.

The Medical Department of the Guard is to-day in the best condition it has ever been since I have had the honor to bear a commission. A glance backward will give a clearer idea of this. In 1870, when I first joined, no examination of medical applicants for entry into the Guard was required. In the Orange riots in New York, in July, 1871, when serving as Assistant Surgeon of the 71st Regiment, all the medicines we had with us were some morphine pills, which we carried in our pockets, and for instruments, our pocket case.

July of 1877 found me serving as Surgeon of the 10th Regiment, in the railroad riots at West Albany. Some empty cracker boxes and a basket served to carry our medical stores, while private instruments, bandages, and dressings were put in a knapsack drawn from the quartermaster. Following this service the hospital knapsack, with a general operating case and pocket case of instruments, was issued and kept in store in New York, and country commands had to take the field if called on without anything until requisitions could be filled.

Under the able administration of the late Adjutant-General, Gen. Josiah Porter, aided by the experience and practical knowledge of our wants by Gen. Bryant, we are now better equipped with medical officers and stores than ever before in our history. Our work at Buffalo showed the advantage of the examinations and care in the selection of doctors for military surgeons, and the advantages of the instruction received at the Camp of Instruction at Peekskill. The particular work of each surgeon was looked into by the Surgeon-General, advice given and suggestions listened to, he following up the short campaign by getting better facilities for more efficient duty by the medical staff. That the medical officers present in Buffalo did their work well and truly is attested by the telegram sent by the Surgeon-General, after he had visited each camp, to the Commander-in-Chief: "I find little to criticise, much to approve, and nothing to condemn."

SUPPLY TABLE — MEDICAL AND SURGICAL STORES.

TO MEDICAL OFFICERS:

The following supply table shows what stores may be drawn upon requisition. Medical Officers making out requisitions will not exceed quantities placed opposite the articles, and will only draw what is absolutely necessary. At the end of the service they will account for the amount of supplies drawn. Requisitions should be made in duplicate, one to be forwarded, when made, through regular channels, the other sent in by the officer making it with his report of service:

MEDICAL STORES.

Acetanilide—powder,	2 oz.	Pills — camphor and opium,	100
Ammonia, aromatic spirits,	6 oz.	Pills — comp. cathartic,	100
Ammonia, chloride,	½ lb.	Paraffine oil,	4 oz.
Ammonia, carbonate,	2 oz.	Quinine — powder,	2 oz.
Atropine, 2-gr. solution,	1 oz.	Rhubarb — powdered,	2 oz.
Collodion,	2 oz.	Soda, bicarbonate,	1 lb.
Cubebs — powdered,	4 oz.	Soda, biborate,	2 oz.
Cocaine, 4-per cent. solution,	2 oz.	Salicylate cinchonidia,	1 oz.
Extract digitalis, fluid,	1 oz.	Spirits etheris nit. dul.,	2 oz.
Extract gelsemimum, fluid,	1 oz.	Squibb's diarrhea mixture,	6 oz.
Ipecac — powdered,	1 oz.	Tincture aconite,	2 oz.
Menthol,	½ oz.	Tincture opium,	2 oz.
Morphine, ⅛-gr. tablets,	100	Tiucture iron (muriate),	2 oz.
Potash, acetate,	4 oz.	Tincture iodine,	2 oz.
Potash, chlorate,	2 oz.	Whisky,	½ gal.
Pills — podophyllin, comp.,	100	Zinc sulph. crystals,	1 oz.

SURGICAL SUPPLIES.

Acidi carbol. (95-per cent. sol.,	2 oz.	Gauze, plain,	5 yds.
Antiseptic tablets (7½ grs. hydrg. bichlor.),	50	Iodoform,	1 oz.
Absorbent cotton,	1 lb.	Oakum,	1 lb.
Alpha bulb syringe,	1	Roller bandages, 2½-inch,	1 doz.
Cotton, Absorbent,	1 lb.	Rubber plaster, 1-inch, 5-yd. rolls,	2 rls.
Chloroform liniment,	8 oz.	Royal Excelsior P. syringe,	1
Ether,	1 lb.		

MISCELLANEOUS.

Atomizer (oil),	1	Eye droppers,	2
Blank labels,	1 box.	Graduated glass, 1-oz.,	1
Bottles, 4-oz.,	2 doz.	Spatula, medium,	1
Camel's hair brushes,	2	Scales,	1
Corks, assorted,	½ gross.	Vaseline,	1 lb.

In sending in sick reports medical officers should specify the number of their respective camps.

ROSWELL PARK,

Major and Brigade Surgeon, Fourth Brigade, N. G. S. N. Y.

MEDICAL SERVICE OF THE NATIONAL GUARD OF NEW YORK DURING THE BROOKLYN STRIKES, 1895.

By Wm. E. Spencer, Major and Surgeon, N. G. N. Y.

The ordering of the 2d Brigade on duty on January 18, 1895, was perhaps the most unexpected and forcible demonstration of emergency service the National Guard of this State has seen since the war, as at the time the first call for troops was made the strike had been on for several days, and seemed to have resolved itself into a question of endurance on either side, and the public did not anticipate in the slightest degree the sudden change in the aspect of affairs; and occurring, as it did, in the the middle of Winter, placed all of our medical officers on the anxious seat to keep the health of the various commands where good and continued service could be rendered, and the results show that the wisdom of State Headquarters in giving attention to the Medical Department after the Buffalo call, and the money expended in equipment, was not wasted; and the endurance of our troops, the very small percentage of sick (considering the number of men on duty, and quarters they had to occupy), demonstrates that the system of physical examinations in force in this State had been closely followed by our surgeons, and resulted in wonders for the service.

The 2d Brigade, for the most part, were at their assigned posts by 8 A. M., January 19, and leaving their armories in a snow-storm before daylight, in some cases without food or coffee, were on duty in the most exposed part of the city; and in this connection, it is not a very high tribute to those responsible that, in a city the size of Brooklyn, any battalion or company should have been compelled to go without food of any kind until noon; for, receiving orders on the evening of the 18th, there was certainly time to supply at least sandwiches and hot coffee to those who had to go on duty in the morning.

Sunday night (the 20th) the troops from the 1st Brigade commenced to move, and by 10 A. M. the 21st the city presented a remarkably warlike appearance.

The quarters to which the troops were assigned were, for the most part (of necessity), just what they should not have been, from a medical standpoint, and ran from an open shed, with mud and salt for a floor, with the atmosphere like a cold-storage room, to the engine-room of a power-house with the temperature in the nineties. There were exceptions, for some places were habitable, and one, the buildings of the B. H. R. R. Co., even luxurious.

For the first few days, not knowing how long the service was to last, temporary arrangements were made, both regarding food, sleeping, and other facilities, and the knowledge and genius displayed in extemporizing everything needful was noteworthy, but as the days went on progress was made, and the Medical Department was in a position where its work could have gone smoothly on for years, if necessary.

The medical service in the various organizations was carried on on practically the same basis, and the difference in attention to details and care exercised by the officers made the arrangements and results from good to excellent, for in no case could serious criticism be made. The regiments being divided for duty into battalions and companies, some considerable figuring was required to place available men in positions of most advantage, allowances being made for sudden changes of position; the rule was that central or exposed positions were taken care of by the surgeons and assistants; where a company was at some distance from regimental headquarters an assistant was usually in charge, with Hospital Corps men where necessary, and quite a supply of medical stores to supply adjacent posts; these posts were in communication with each other, and reports were sent in by those in charge, as a rule Hospital Corps men, to the assistant, he in turn making his reports to the surgeon, to be transmitted by him to Brigade and Regimental Headquarters. The surgeon visited each post in his organization daily, and while in charge of the main station of his regiment (*i. e.*, as regards the number of men), was thus in communication with all detachments. And in no case, so far as known, was any detachment on active duty without the presence of a medical officer or Hospital Corps man.

In most cases the Hospital Corps men were used for their legitimate purpose, but in some the commanding officers of organizations interfered with the work; one instance occurred where, had orders been *promptly* obeyed, the three surgeons and entire Hospital Corps would have been on duty with a single company; another where Hospital Corps men were ordered on sentry duty, and still another where the Hospital Corps were ordered to cook for the field and staff of a certain regiment, which did not improve the usefulness of the men from the standpoint of surgical cleanliness. These abuses, fortunately, were not frequent, and barring an occasional clash, the medical officers were permitted to have full control of their respective corps; and it was noted that when the above policy prevailed the best results were attained, and also it was expected that the department should have a general supervision of the food and quarters.

Some of the commanding officers requested and expected an inspection of the food, and held the medical officer to a certain extent accountable for the proper cooking and service; others trusted this entirely to the commissary department, and made any suggestion from the medical officer an issue.

The arrangements for feeding the troops ranged from sending cooked food to outposts from the armories—in some cases this coming from an outside caterer—to each organization depending entirely on its own resources, both in armories and outside, and by far this arrangement gave the most satisfaction, and in this connection it may be stated that the organizations attending to their own wants demanded the supervision by their medical officers of the food question, and that also from these the best reports came into Brigade Headquarters, and showed that the various departments assisted each other, having in view but one thing, *i. e.*, how to best take care of the men.

Reports regarding the sick, wounded, sanitary condition of posts, etc., came into Brigade Headquarters with more or less regularity at first, but improved daily, and in nearly all cases were satisfactory as showing that the officers, as a whole, were fully alive to and gave matters requiring detail their close attention. Some were models, others left some things to be desired, and while nearly all came in through the regular channels, some assistants saw fit to send theirs in direct.

It was interesting to see the daily improvements attained. Wretched quarters were made habitable, unsanitary quarters became sanitary, and cleanliness was the rule; and when one thinks of the difficulties in the way of these ends, on account of the railroad employes and the desire of the companies to save money, the results were more than good.

Two or three small-pox and scarlatina scares were widely advertised, but in the commands small notice was taken of them, and the Board of Health promptly investigated all rumors, besides co-operating with the medical officers. They visited all posts, and enforced strictly the sanitary ordinances compelling the companies to do as they were asked by the Medical Department; and right here note should be made of the quiet but determined stand taken by the officers to discriminate between attention to the members of the Guard and the railroad employes, for at the start the roads apparently thought our officers were to take care of their men, as was properly done in all cases where humanity and emergency demanded, but in a very short time, with the co-operation of the railroad surgeons, the line was distinctly drawn and an element of possible criticism fully removed.

An improvement should be made in the method of demand for and distribution of supplies, as the bills for medicine, etc., showed a great difference in amount, and often had no relation to the number of men in a command; some officers, evidently considering this a proper occasion, ordered enough not only to replenish but supply their organizations for future times, while others kept their bills so low that they must have called upon their private resources.

The details of casualties and sickness do not properly come within the scope of this article, but they were very small, and were made so largely by the close attention to duty of our medical officers and the willingness of the men to accept advice, while the interest of the Hospital Corps was extreme, and no class of men in the service showed more willingness to learn and attend strictly to duty.

No men in the guard made more personal sacrifices than the medical officers of the two brigades; they gave up their business in the busiest season of the year, took all the hardships incident to the service, set a good example to all, and in no case were any complaints made, though many of them suffered a serious loss by re-

sponding promptly to the call for duty, and the State can make no mistake in fully appreciating their work.

While the lessons learned at Buffalo have been acted on, we feel that we have not gone quite far enough and, in the opinion of the writer, much can yet be done to place the department where it belongs, and the following suggestions are made after consultations and mature deliberation:

1. That a reorganization of the Hospital Corps be considered, giving twelve men (beside the hospital stewards) to each regiment, and a proportionate increase, over the present details, to battalions, squadrons, and separate companies; this to include batteries and signal corps. That these men should be enlisted in the corps is apparent, thus doing away with all clashes between commanding officers and surgeons, so that uniforms, equipments, rations, etc., should come through the surgeon as head of his organization, and the man is answerable to one head only—a state of affairs that can not be arrived at so long as men are detailed. The strength of a company would be real, and not apparent, and the right of a surgeon to his own men could not be questioned.

2. The corps men should either wear the present insignia on both arms or, better still, the old brassard, that shows at a greater distance; and on active duty should be *officially* armed with revolvers, for while they are classed as non-combatants, a mob has not that fine sense of discrimination that marks a deliberate body, and a corps man is just as liable—perhaps more so—to get his head broken as any one, and while we are engaged in a pacific manner, an argument backed by a pistol might stop discussion with a mob, and facilitate the progress of a man on a litter.

3. Our equipment is not sufficient. We should have increased medical and surgical supplies ready, in convenient chests and packages, for instant use; and the adoption of a proper and practical litter should be attended to at once; and while an ambulance would be a great addition, it is felt that in the large cities, where we are most liable to be called on for duty, the ambulance service of the hospital can be depended on.

4. A uniform system of blanks for use on this duty, for the proper and regular forwarding of reports from Hospital Corps men and assistants to the surgeon, that he might make up a report to send to head-

quarters and also to keep on file, would not be amiss, and would be a valuable aid to correct statistics.

Could the State afford it a proper service-shoe, as a part of the uniform, would add greatly to the comfort as well as efficacy of the men, and is an important item for consideration.

A thorough understanding of the relation of a medical officer to the commissary department should be arrived at, and in many cases the commissary department could learn the value and sustaining power of a proper ration by consultation with the medical officer, and it is believed that his supervision of the proper preparation and cooking of food could be made a part of his duties, with benefit to the service.

The present code, wherein a department officer is placed on the same basis as other officers is right, but its provisions are apparently not clearly understood by all, and any method whereby surgeons could learn that their positions are permanent would perhaps make some feel that they could give more time to their work, knowing that a change of regimental or company commandants did not mean that their work had gone for nothing, and their methods liable to be changed by the incoming administration.

Too much credit can not be given to the heads of the department (notably Gen. Bryant and Col. Henry), who have done so much to bring the medical department of this State up to its present standard, for to them is due the credit of having the department recognized as one of the most important in the service, and it is with great pleasure that we are able to state that our present Surg.-Gen. Terry is determined that the department shall make as many strides forward in the future as in the past, and that the present policy will be to foster and maintain a proper pride and interest in the service, and to make all see that a medical department has far-reaching ability to add to the effective force of the State. * * * *

This little paper is sent with the apologies of the writer (the original never reached its destination), as being written at a late date from notes made during the Brooklyn trolley strike, and not covering the ground as fully as the original; but the delay allows this as a postscript, that is, that a committee is now at work on many of the recommendations mentioned here, with others of greater value, to properly arrange the matters, that they may come before the author-

ities for action, and as this committee is the result of a meeting of the medical officers of the State, called by the Surgeon General, we can, with confidence, state that the proposed changes will meet with his approval, and in the near future we will see the medical department of this State second to none.

FIELD HOSPITAL SERVICE OF THE NATIONAL GUARD OF PENNSYLVANIA AT THE TWENTY-EIGHTH NATIONAL ENCAMPMENT OF THE GRAND ARMY OF THE REPUBLIC.

By C. CHASE WILEY,
Major and Surgeon, 18th Regiment Infantry, N. G. P.

Not until within the Christian era was there anything like thoughtful, concerted, or systematic effort made to care for the sick or wounded upon the field of battle. Early Biblical history gives us no detailed account of any organized effort in this direction, either among the Jewish people or Pagan nations. In most cases the wounded were left on the field of battle, to care for themselves or fall into the hands of the enemy to be killed and robbed. Scriptural accounts of ancient usages toward the wounded or the vanquished show the treatment, irrespective of sex, to have been most atrocious. The leaders were put to death, the bodies of the killed plundered, the wounded slain, savagely mutilated, or carried into captivity. These drastic measures were not confined to any particular nation, but were in keeping with the spirit of the age, and were universally practiced. The Mosaic law, in a measure, however, softened and mitigated these atrocities by restricting the killing to armed warriors.

As early as B. C. 500 the Greeks and Romans had some humane regard for the fallen and, in a degree, cared and provided for their wounded. This is shown by ancient sculpture, depicting the eventful and decisive battles of the age. At the National Museum in Naples may be seen reproductions of some of these famous sculptures, notably that taken from the frieze on the temple of Bassae, Greece, which portrays the battles of the Greeks and Trojans before the walls of Troy. A soldier is being carried off the field, those attempting to convey him to a place of safety being

guarded by fellow-soldiers, with drawn spears and uplifted shields, to ward off the attack of the enemy while covering the retreat of the rescuers. Also, in the monuments erected during the invasion and occupation of Gaul by Julius Cæsar, evidences have been found indicative of the existence of a medical staff in the Roman army. The late Sir James Simpson, a renowned surgeon—physician to the Queen—made this subject a feature of special investigation, and his conclusions, published in the Edinburgh Monthly Journal of Medicine, under the head of "Transactions of the Society of Antiquaries of Scotland," as well as other writings and researches, and from his deductions it has been tacitly accepted that, prior to the reign of the Cæsars, there was virtually nothing, in time of action, worthy of the name of Field Hospital Service. As painting and sculpture simply "hold the glass to nature," and are but a reflex of the times and customs with which they are contemporary, it may be reasonably inferred that the copies taken from the temple of Bassae. as well as the monuments mentioned, faithfully portray the incidents of the most important conflicts of that age, and show a partial effort to care for the wounded, and their removal to some retreat of safety for provisional treatment.

Thus, we have an outline of a simple form of Field Hospital Service in vogue among the nations of antiquity, whose business was largely that of war, and among peoples whose principal aim and thought was that of conquest.

Again, as remotely as B. C. 370, history tells us that the first type of a permanent hospital (of which we have any direct knowledge) was established in the Portum Romanum by one of the most famous bishops of that day.

Casually, it may be mentioned that the establishment of hospitals for the sick and injured appears to have had a monastic origin. The monks of the early ages were noted for their care of the sick and wounded that were taken to the various monasteries established at that time throughout Asia and the Roman Empire.

Following these monks came the order of the famous and efficient Hospitalers, better known as the Sons of St. John, who, together with the order of the Sisters of St. John, devoted their lives to the care of the sick and wounded in the Crusades and other wars. Emblematic of this order, a white cross was worn by these Sisters, which

was followed by various insignia and flags of different colors and designs, until the employment of the long-used yellow flag and the subsequent adoption of the red cross for field service, at the Geneva Convention, in 1864.

From the establishment of the first field hospital, with its attendant corps of surgeons, at the close of the Sixteenth Century, through the period interspersed by the Napoleonic wars, the American Revolution, the War of 1812, the Mexican, Crimean, Civil, Turko-Russian, and Franco-Prussian down to the present, there has been a continuous improvement in the Hospital Field Service, in keeping with the advance in both sanitary and surgical progress, looking to the amelioration of the sick and wounded.

Notwithstanding the deadly results of modern warfare and the many improved engines of destruction, our science has kept even pace, so that the evil and the remedy now confront each other. During the hardships and perils of field and camp, long and weary campaigns, there has always been engendered a spirit of dependence and comradeship among the soldiers of all nations. In recognition of this universal spirit of fealty, exceptionally marked among the soldiers of the late war, it is eminently fitting upon this occasion to note the fact that Dr. Benjamin F. Stephenson, a volunteer surgeon of the 14th Illinois Infantry, was the first to conceive the idea of the establishment of the Grand Army of the Republic, and subsequently formulating the plans for the annual encampments of that patriotic organization to keep alive and perpetuate the fraternal regard of the old soldiers, and to revive and intensify the grateful sentiments of the younger and rising generation.

Upon the selection of Pittsburg for the twenty-eighth National Encampment of the Grand Army of the Republic, and my subsequent appointment as Medical Director, I decided to establish a hospital field service, in conformity with that now in use by the National Guard.

I placed seventeen field hospitals, fully equipped, in charge of the regulation number of surgeons. Attached to these were seventeen hospital stewards, sixty-eight litter bearers, seventeen ambulances, and drivers. This corps cared for and treated a total of seven hundred and thirty-three soldiers and visitors. A daily report was

furnished me from each hospital, sixty-eight wards and surrounding boroughs, and the city hospitals in Pittsburg and Allegheny. These reports embraced a complete history of each case, giving the name of the patient, disability, Post, State, city, where quartered, and its disposition. The entire work was accomplished at an expenditure of $911.49, the whole equipment having been furnished me by the State, through the courtesy of our late Adjutant-General, W. W. Greenland. The local National Guard organizations extended additional courtesies by a volunteer escort, composed of fifty commissioned officers and seven hundred and nineteen enlisted men, under command of Col. N. M. Smith, covering fifteen railroad stations, and conducting a total of thirty-two thousand visitors to quarters assigned.

Under my direction 400 civilian surgeons were appointed, by whom daily reports were furnished regarding the sick or injured, sanitary condition of the various school buildings, public halls, and armories where the veterans were quartered.

The territory covered by these arrangements was embraced in a circumference of fifty miles, containing a permanent population of about 600,000, with 250,000 visitors.

Along the line of march, extending a distance of five miles, were pitched the hospital tents at intervals of a third of a mile.

Upon request a special police reserve was stationed along the line of parade as a signal corps, whose specific duty was to signal by flag any demand for ambulance or surgeon.

In the line of column were interspersed the ambulances. After conveying the disabled to the hospital tent the ambulance regained a position and proceeded with the column. At the close of the review all ambulances returned to the respective hospital tents to which they had been assigned.

A very large reception was given at East Pittsburg, at which five thousand guests were present. The medical staff in attendance included our Surgeon-General, division, brigade, regimental, and naval surgeons. A military hospital was established within the building in charge of a steward, with litter bearers, and supplied with cots, medicines, and the necessary surgical appliances.

During the period of service the system was a subject of widespread interest and commendation. The tents were visited at all hours by soldiers and citizens.

In conclusion, it may be said the departure made in establishing field hospital service in a populous city was an undertaking involving inconceivable responsibility and labor; commensurate therewith, however, was the practical demonstration of its possibilities upon future and similar occasions.

NOTES ON THE WOUNDED ON THE BATTLE-FIELD.

By Major Vladimir F. de Niedman,
Surgeon, First Regiment Infantry, Kansas.

The proper removal and disposal of the wounded from the battle-field to places of comparative safety, where they can receive surgical attention, particularly the removal of the injured from the fighting line as speedily as possible, is a question deserving special notice.

Consider for a moment that in the future war an entire division may be employed as an attacking force; there will be at least 100 companies of infantry alone in the engagement, not counting batteries of artillery, or troops of cavalry, usually attached to divisions, in all, probably 10,000 men. Whole battalions, regiments, or even brigades, may be deployed in an extended order, covering a long line of attack, or defense, as the case might be. Advantage of cover is taken, all the terrane could possibly afford, and the dead and wounded would be found along the whole line of attack, or defense, wherever they fall, be it behind trees, rocks, shrubbery, or in ditches.

The number of injured will depend somewhat on the protection afforded by the terrane, on the accuracy and precision of firing, and a good visible target. At a distance of 2,000 yards the probability of wounding in an extended order would not be so great, but at 1,500 yards there will be more injured, and many with perforating wounds. At the distance of 1,000 to 800 yards the greatest number of wounded will be found, many of whom would require immediate attention and speedy removal to the rear — to the first dressing station. Of those shot at 500 yards or nearer, many, I fear, would have no need of a surgeon or surgical dressings, for, if not killed outright, death would likely result from shock, or hemorrhage, long before assistance could reach them.

Presume that the attacking force, advancing in an extended order, presents a front of one battalion of infantry, and allow the regulation distance of two paces, or six feet to each man, the extended line will be 2,400 feet, and if the formation is of any great depth, one battalion behind the other, regiment following after regiment, the dead and wounded will be found, as already stated, not only along the whole line of advance, but also in all manner of shapes and places.

The greatest number of wounded will be no further than 1,000 feet from the enemy's firing line, and nearly all of the injuries will be of a very serious nature, requiring immediate attention. The usual ratio of the dead and wounded has been one killed to five wounded, but with the introduction of the small bore infantry magazine arm there is not only an increase in the number of wounded, but the number of killed will be greater also — an average of four dead to one wounded. This is taken from the reports of Rivero and Past Assist.-Surg. Stitt, U. S. N., during the late Civil War in Chili, where the Manlicher 7.6 mm. caliber rifle was used. The cause of the tremendous increase in the death rate was chiefly due to immediate hemorrhage.

Consider now the dangers and difficulties the Hospital Corps will have to encounter. Not only will there be an enormous Hospital Corps force required to cover the entire terrane effectively, to find and attend to the wounded along the whole line of advance, but their most urgent and greatest service will be needed right under the enemy's fire, not 1,000 feet from the firing line. Their work must be done quickly and intelligently — and while the Geneva Cross on the left arm assures them from capture, yet it does not assure them from being killed.

Paragraph 1375, Regulation U. S. Army, provides that, "during an engagement the company bearers shall, under orders of their commanding officer, give first aid to the wounded, or carry them to the rear, until relieved by members of the Hospital Corps." There is, on the same subject, a decision of the Surgeon-General, rendered June 13, 1891, "that each bearer, in addition to his fighting outfit, should be equipped with a field tourniquet and a package of dressings. (Capt. J. L. Powell, U. S. Army.*) In a little book enti-

* Fourth Annual Proceedings of the Association of Military Surgeons of U. S., pages 330 and 333.

tled "Troops in Campaign," Regulation for the Army of the United States, 1892, paragraph 265 (Battles), I find the following: "During the action the officers and non-commissioned officers *keep the men in the ranks* and enforce obedience if necessary. Soldiers must not be permitted to leave the ranks or strip or rob the dead, nor even to assist the wounded, except by express permission, which is only to be given *after the action is decided.* The highest interest and most pressing duty is to win the victory, by winning which only can a proper care of the wounded be insured. In case of a serious engagement I believe no great reliance for help can be placed upon company bearers to remove the wounded from the firing line, for, by taking away four men from each company, forty will be withdrawn from a regiment, and 400 from a division, and no general officer will consent in a critical moment to the reduction of his fighting force to such an extent.

The use of the company bearer will be, in all probability, limited to rendering first aid within the fighting line, averting impending death, and rendering the wounded as comfortable as possible while awaiting the approach of the members of the Hospital Corps. On these, no doubt, the entire burden of the movement of the wounded from the battle-field to the first dressing station will rest. Capt. J. L. Powell, of U. S. Army, in his able paper, "Observation on the Organization and Efficiency of the Hospital Corps," justly states that: "The removal of the wounded from the battle-field, and their transportation to the hospital, is the most defective part of the Medical Service." It is unquestionable, that our present means of removing the injured speedily from the fighting line to points of safety will be found far from adequate should the necessity arise.

If we place, in a division engagement, the supposed number of wounded at fifteen per cent, we will have 1,500. Of these, 500 will be severely wounded; 1,000 slightly, of whom 500 will be carried, making a total to be carried of 1,000 men. If the collecting or first dressing station is three-fourths of a mile in the rear of the fighting line, each litter squad of two men will have to march one and a half miles to the collecting station and back, or it will make six miles in four journeys in two hours; or put it in a different way, it will require 250 litters of two men each to carry 1,000 wounded from the fighting line in two hours, or 125 litters in four hours,

making eight journeys, walking twelve miles; or sixty-three litters, 126 men, in eight hours, making sixteen journeys, walking twenty-four miles. This is hard work. Then, if we take the distance from the first dressing station to the field hospital at about three miles further in the rear, and admitting that the ordinary ambulance wagon holds two wounded on the litters, or one recumbent on litter and four sitting, or eight sitting—an average of five—with thirty ambulance wagons it will take seven trips, covering six miles each time, or about forty miles for each wagon team. This again leaves 500 slightly wounded, who will be obliged to find their way to the rear the best they can. Should the engagement last a whole day, the number of wounded would be still greater, and many would be left on the battle-field unattended till the next day. With our present facilities it is doubtful if a sufficient number of the Hospital Corps, with litters and ambulance wagons, could be brought together to dispose of such a number of wounded promptly.

Major John Van R. Hoff, of the U. S. Army, suggested lately that the lectures on "First Aid to the Wounded" should be added to the curriculum at West Point Military Academy. This is a move in the right direction. Why should not a line officer be familiar with and perfectly at home in the use of the field tourniquet and dressing package? If proper instructions are given by both line and medical officers, at the various garrison and post schools, in the first aid to the wounded, or at least in how to apply a tourniquet and bandage, there will certainly be more men right in the first line of battle who could, without diminishing the fighting force, give intelligent aid to each other till relieved by the Hospital Corps. So, in our State schools and colleges where military science and tactics are taught by military professors, the instruction given is altogether one-sided, for while the pupils are taught how to march and how to disable the enemy, they learn nothing of the *other* phase of practical warfare — of military sanitation — how to care for those who are disabled, and what to do with them.

Some plans should be devised whereby surgeons of the National Guard would soon have the privilege of attending the Army Medical School, and thereby become proficient and familiar with the system and duties connected with the U. S. Army Medical Department. Such knowledge would be of inestimable value to surgeons

of the National Guard, for, knowing exactly how to, would signify a correct instruction of the Hospital Corps, company bearers, and others, by drills and lectures during the annual regimental or brigade encampments, with a direct result in increasing the number of better trained officers and men.

Should ever an emergency arise whereby the National Guard will be called for duty, side by side with the regular Army, we will then have the assurance of perfect harmony of action in the Medical Departments, and the burden of taking care of the wounded properly will be thus lessened.

Believing sincerely that the success of the campaign in our future war will greatly depend upon the prompt and proper disposal of the wounded, the solution of this problem can only be accomplished by increasing the number of our Hospital Corps, providing them with every facility to make their work effective, and by systematic instruction and suitable training of the men in the rank and file proper.

AMBULANCE CONSTRUCTION.

By CHAS. R. GREENLEAF,
Lieut.-Col., Deputy Surgeon-General, U. S. Army.

In considering this subject it is necessary to bear in mind the fact that there is a difference between the conditions under which an ambulance is used in civil and in military service. In the civil service it is generally used to transport one, or at most, two patients and a few emergency supplies over evenly paved streets. In the military service it is used to transport either one or two seriously, or as many slightly, disabled patients as the vehicle can carry, together with their arms and accouterments, and such medical and surgical supplies, food, and water as will be required for many wounded, over roads that are liable to be rough and mountainous; indeed, except for the fact that both are four-wheeled vehicles for the transport of the disabled (two-wheeled vehicles being universally condemned), the differences in detail of interior construction are so considerable that, in treating the general subject my remarks must apply to the military ambulance.

The essential object of an ambulance wagon is to transport the disabled from one point to another with the greatest possible comfort and security to their persons. The prime mechanical factors necessary to secure this object (assuming that the strength of the vehicle is assured) are that its body is swung sufficiently below the center of gravity, and that the springs on which the body rests are so constructed and arranged as to insure a minimum of motion to the occupants. It has been said, and perhaps with truth, that no ambulance has yet been constructed in this country that is superior in these respects to the "Wheeling" pattern that was used during the War of the Rebellion, yet before the war closed the department was actively engaged in the preparation of a new pattern, presumably because the Wheeling pattern did not give satisfaction, and its work has been continued to the present time without a fully successful result. Four

patterns of ambulances have been built during that period; one, the Red Cross of 1878, from specifications prepared by a Board of Officers that deliberated three years before reaching a finding. I have obtained copies of the specifications from which each of these patterns and the Wheeling were built, and from this data have tabulated, for the purpose of comparison in the following statement, the figures which show the height from the ground, the diameter of the wheels, and the number and arrangements of the springs. For further comparison similar data, relative to the British and Swiss regulation ambulances and the New York Hospital Ambulances, are added:

	British.	Swiss.	Wheeling.	Rucker.	Quarter Master Department, 1875.	Red Cross 1878 Otis.	1892.	N. Y. Hospital. Abbot-Downing Co.
Weight, lbs.	1,800	2,200	1,040	1,125	1,180	1,700	1,200	1,450
Height of body from ground, feet	3.3	3.4*	3.3⅝	3.2	3.2½	3.1	3.4	2.8½
Diameter of front wheel, feet	3.	2.4	3.5	3.6	3.6	3.6	2.11	3.
Diameter of hind wheel, feet	4.8	3.4	4.1	4.2	4.2	4.2	4.3	4.
Track from center to center, feet	5.2	...	5.0	5.0	5.0	5.0	5.0	4.6
SPRINGS.								
	Platf'rm.	Plat-f'm. Very str'g.	Ellipt'cl.	Platf'rm.	Platfr'm.	Platf'rm.	Platf'rm.	Platf'rm.
No. of plates on side, front	14	8	..	14	14.	14	14	14
No. of plates on side, rear	14	8	16	14	14.	14	14	14
No. of plates on cross, front	5	7	12	7	7.	7	8	7
No. of plates on cross, rear	5	7.	8	7	7.	7	8	7
Total number of plates	38	30	36	42	42	42	44.	42
Sweep of springs, inches	..	..	..	..	6.	5.	4¾–5	4½

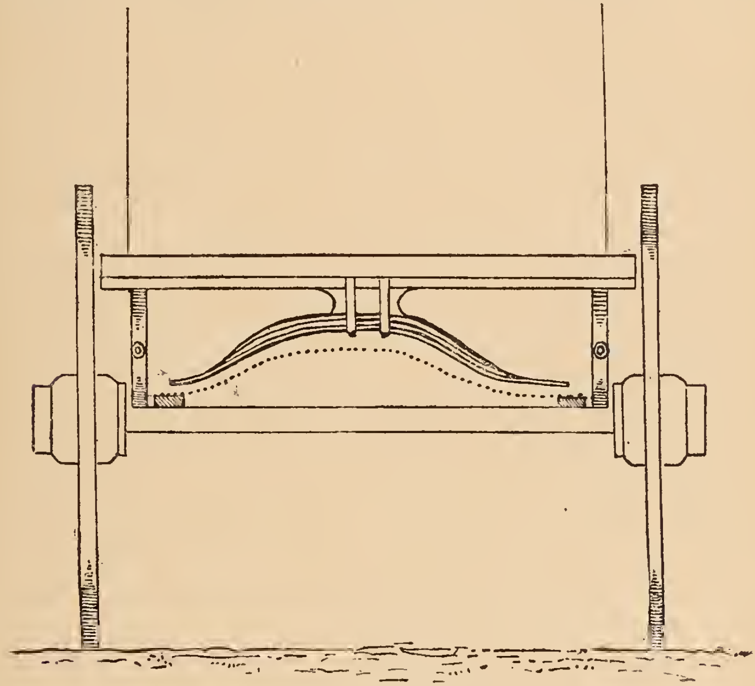
*This does not include the "well" for patient's effects, and for the use of patients when sitting upright, but is the height of the body of a recumbent patient from the ground.

A study of these figures leads to the belief that the designers of the Wheeling ambulance, and the designers of all patterns that followed it, worked from entirely different standpoints. Judging from the lessened diameter of wheel, and the less number and unequal distribution of the springs, the Wheeling pattern was designed with a view of securing the *greatest comfort* to such recumbent patients as it might be called upon to transport; while from the larger-wheel diameter and the greater number and regular distribution of springs on the others it would seem that they were designed

for the comfort of the *greatest number* of patients who could sit uprightly. All workers were satisfied of their inability to design a vehicle that should combine both of these conditions, and each took as his working model an opposite horn of the dilemma presented to him; possibly, the later designers were governed by the conviction that a certain amount of the comfort of the severely wounded must, of necessity, be sacrificed to the demand for a rapid clearance of a battle-field, and that, therefore, the maximum capacity of an ambulance was to be considered rather than the comfort of its minimum occupancy. It will be further seen in the tabulated statement that there is a marked uniformity in the calculations regarding the number of plates the several springs shall carry, be they in the form of the ellipse or the platform. With but few exceptions, viz., in the patterns of 1892 and in the Wheeling, they all have twenty-one plates each on the side and cross-springs; the former has two extra plates on the cross-springs, and the latter has three extra on the rear cross, but has nine less on the front spring. In the Wheeling pattern the springs placed under the front of the body are directly active in sustaining its weight, while in the others, notably in those having a "cut under," the direct weight of the body is mainly sustained by the rear springs, those in front carrying it indirectly through the fifth-wheel and king-bolt. Regarding the height of the body, there is but three-eighths of an inch difference between the Wheeling and the 1892 pattern, while the others vary from this standard by two to three inches. I think three feet four inches is too high; the maximum height from the ground, in any ambulance, should not exceed three feet one inch.

It may be confidently expected that a solution of the problem for equalizing motion, when a light or heavy load is to be carried in the same vehicle, will be found in an arrangement of springs common on vehicles that are extensively used on the Pacific Coast, for carrying, as occasion may require, either light or heavy loads of fragile property that demand an equable motion for safety in transportation over rough roads. I do not know whether it is to be found on Eastern wagons or not; it certainly has not been applied to any pattern of ambulance that I have seen, although mention is made by Longmore, in his description of the British ambulance, of a somewhat similar contrivance on that wagon. (Gunshot Wounds,

Ed. 1877, p. 547.) It consists in fastening an auxiliary half-spring to the under side of the rear portion of the body of a wagon, immediately over the rear axle; the ends of the spring are free, and are separated from the axle by a space of about two inches; the plates and "sweep" are of such size and dimensions as may be required to sustain the maximum load of the vehicle; the reg-



Showing the Auxiliary Spring.

ular springs are made for the minimum load. When the maximum load is in the wagon the bed is so far lowered as to bring the free ends of the auxiliary springs in contact with a plate fastened to the upper part of the axle, and thus to receive with ease and safety the weight of the added load which it carries in conjunction with the regular springs.

Applied to the body of an ambulance, this auxiliary spring meets the condition that is essential in service for supporting an extra weight; the regular springs, whether they are elliptical or platform,

should be constructed to sustain, without undue motion, the weight of the body of the vehicle, the driver, and two patients; the auxiliary springs should be calculated to sustain the weight of eight or ten additional patients, as the case may be.

Under instructions from Surgeon-General Sutherland, in 1891, I prepared the general plan on which the ambulance (pattern of 1892) was built, but this plan was changed in some of its details after leaving my hands, by persons over whom the Medical Department had no control. Through the courtesy of Surgeon-General Sternberg I have been allowed to read the criticisms that have been made upon the vehicle, after its trial in the field; the principal adverse criticism is that it causes inconvenience to the occupants when a light load is carried. This criticism is well founded, and the conditions that led to the defect grew out of the common ignorance at that time of any solution of the mechanical problem to which I have just referred; the defect may, however, be wholly corrected by lowering the body, through a lessened diameter of wheel, and by adopting the auxiliary spring, lightening at the same time the present spring to bear the minimum load. The other new features of the vehicle—its light weight, the "cut under," the length of body to accommodate the new stretcher, the side lamps, the carriage of emergency dressings, and extra stretchers—met with general approval, and I am satisfied that if the changes referred to are made this ambulance will meet the requirements for a vehicle of its character.

It should be said, in justice to the designers of all these ambulances, that the statements regarding the discomforts in riding are based upon a misuse or abuse of the vehicle; that is to say, when, with a light load, it is driven at a high rate of speed. These were not the conditions of service upon which the designers made their plans. An ambulance carrying recumbent patients should not be driven at a pace faster than a walk, unless under extraordinary circumstances, when personal comfort can not be regarded. Longmore states, "As a rule, the wagon [ambulance] will only be required to move over made roads, and not faster than at a walking pace." (Gunshot Wounds, Ed. 1878, p. 548.) No wheeled vehicle has ever been built that will carry a wounded man with comfort or safety when driven even at a moderate rate of speed beyond a walk; nothing but a travois will insure these factors when rapid transit is

necessary, and on a travois a man may be carried at a gallop without discomfort.

Regarding the *Details of Construction* and the *Character of Material* for ambulance wagons, I have had an extensive correspondence with the leading carriage manufacturers in the country, with officers of the Quartermaster's Department in the Army, under whose direction army wagons are built, and have carefully studied the literature on the subject, especially the reports of ordnance officers who have conducted elaborate experiments on the tensile strength of woods, and from these sources have gathered the following:

DETAIL OF CONSTRUCTION.

The *body* must be of such shape as to receive easily and without crowding, at least two recumbent patients, and, if necessary, the stretchers upon which they are carried, *or* one recumbent and four upright; or eight upright patients, and always one attendant; the driver may occupy a seat or ride one of the horses; it must be provided with a top strong enough to sustain light baggage or extra stretchers, and on its sides, under the floor and driver's seat, and on the bows, there must be accommodations for other stretchers, medical and surgical supplies, some food, water, lamps, the prescribed flags, and some tools. The *top* must be of water-proof material spread on bows of strong light wood, and provided with side, front, and rear curtains, to afford shelter from inclement weather. The *running gear* must consist of a frame that shall be of great strength and light weight; of springs so arranged as to receive the shocks and blows from travel, and support the weight of either two or ten men so that they may travel without discomfort from violent motion. The *wheels* should be of such diameter as will reduce friction (draft in hauling) to a minimum, of such width of felloe as will prevent cutting into soft earth or sand and be mounted on axles, supporting a "cut under" that will permit the vehicle to be turned in its own length; the "track" of the wheels should be the same as that of other military vehicles; and the *pole* should have a free vertical motion, to prevent breakage, and be provided with safety springs to overcome sudden shocks in starting. Finally, the weight of the wagon with its equipment should not exceed 1,500 pounds. This,

with a minimum load, and on good roads, will not be too great for draft by two horses, but four should be furnished in the field, where the maximum load and bad roads may be expected.

CHARACTER OF MATERIAL.

The Body.— Since the weight that must ultimately be borne by the springs is an important element to consider, a great deal of study has been given to the choice of material from which the body should be built. As a rule, one of the several hard woods has been used for the skeleton, frame, and floor, and the white or light woods for panels and interior work; tubular iron has been suggested for the frame, and light woods for trimming; there is, however, a general consensus of opinion that for the frame, first-growth ash or white oak combine the essentials of light weight and strength, and should be the wood selected; for the panels and other interior work generally, poplar or thinly sawed yellow pine should be selected; for the floor selected pine, and for the bows second-growth ash. All these woods should be free from defects, and be well seasoned. This aggregation of hard and light woods, if properly secured by bolts, etc., and made water-tight by oil and paint, furnish a body that will resist for a great length of time the action of the elements, and the violence incident to the service that is required of such a vehicle.

The Running-Gear.— Long experience has demonstrated the fact that hickory possesses the special quality required for resisting the conditions in actual service that lead to speedy decay, deterioration, and breakage of the wood-work used in this part of the wagon. Wrought iron for stays, Norway iron for clips, and steel for axles will insure strength, if they are properly selected; but care must be exercised in gauging the sizes of the different parts, to avoid the sacrifice of strength in the effort to obtain lightness of weight. The wheels should be of a medium diameter. If this is exceeded it will not be possible to secure a low swing to the body, and as the ease of motion gained in this particular more than counterbalances the ease of draft gained from a wheel of large diameter, which is, moreover, an added weight to the vehicle, the smaller diameter is to be preferred; the hubs may be of iron for city service, but for military service a wooden hub, either elm or gum, should be used. Quite

recently the India rubber tire has been brought into use in cities, and has met with much favor, but I do not think that there is as yet sufficient evidence of its durability to justify its use in the military service, where a broad felloe and a well-wrought iron tire is necessary; the same may be said of the wire spoke or bicycle wheel. As a minimum of motion, and, therefore, a maximum of comfort to the occupant is chiefly determined by the springs, great care is necessary in fixing upon their location, their "set" and "sweep," the number of plates, and the character of the steel; as to shape, if there were no other reason of preference for the platform, the fact that with its use the body can be swung lower than with the elliptical should determine its selection. For city use the distance of swing for the body may be arbitrarily fixed, but in a military ambulance it should never be lower than three feet one inch, to allow escape from collision with obstructions, such as rocks, tree stumps, etc., that are found in the bad roads always met with in field service. The top should be made of a frame-work of first-growth ash, supported on light iron rods, capable of bearing the weight of small articles, such as patient's effects, arms, etc., and a stretcher or two. It should be of sufficient height for upright persons to avoid collisions of the head with the upper frame work. The covers should be of good canvas duck, that has been well oiled, and the curtains arranged in widths of three on each side, one in front, and one in the rear; the hooks, straps, or other contrivances for keeping them in place, should be of the best manufacture, as great discomfort is felt by patients from an imperfect fastening of these protectors.

The seat cushions will serve as mattresses for recumbent patients; these and all coverings of interior padding should be made of the best russet bag leather, and all interior details so arranged as to be removable, in order that when soiled the ambulance and its belongings may be thoroughly cleansed.

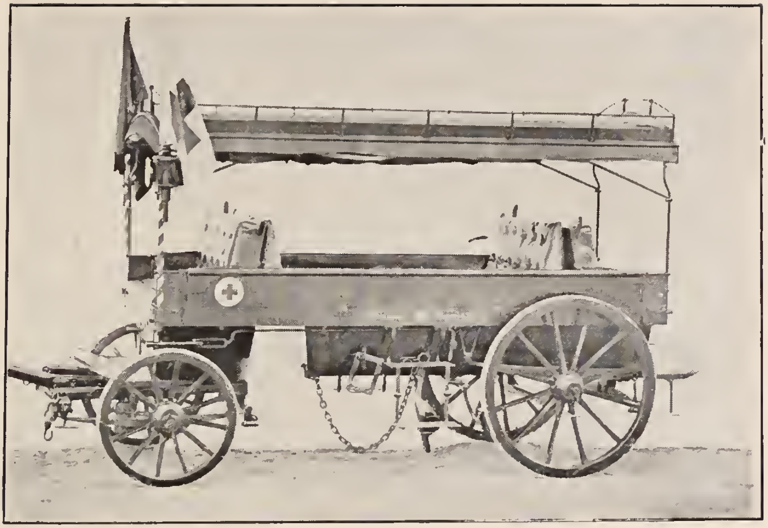
The form of ambulances that have been built in this country is, in my opinion, objectionable, and should be abandoned. There seems to be no good reason why patients should be loaded into an ambulance from its rear, no matter whether they go in head first or feet first; which opinion is in accord with Major Havard's, expressed in his article on "Litters and Ambulances," that was read at the last meeting of this Association. Nor is it evident why patients

who are able to sit up should be obliged to occupy so uncomfortable a seat as one on the side of a wagon. This method of loading and seating patients has many disadvantages, and few, if any, advantages. The act of loading is awkward and involves a probability of injury to the patient, whose position in the wagon after loading is open to the grave objection that he can not be easily reached for the administration of water, food or medicine, for the adjustment of bandages, or for the temporary dressing of a wound. In sitting, the position is necessarily constrained, and the patient must be always alert to keep his seat, from which he is constantly liable to be thrown by the ordinary shock of the vehicle when it is going over rough roads.

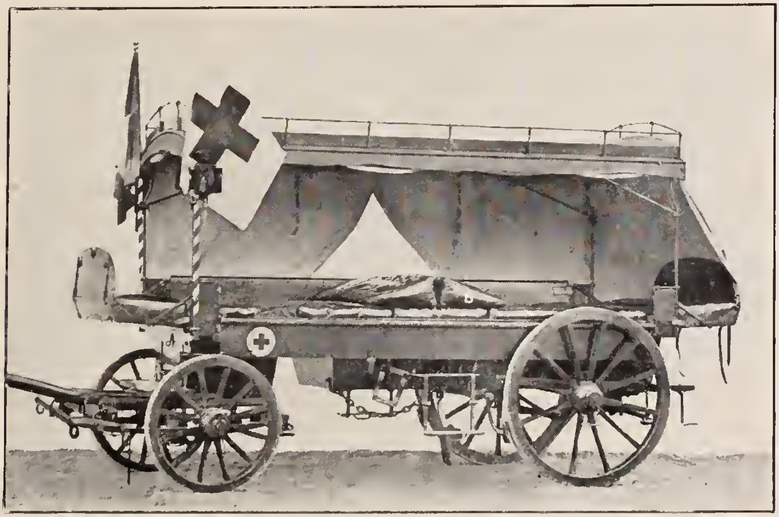
The ideal form of ambulance is to be found in the pattern adopted by the Swiss Government. It is the design of the Surgeon-General of the Swiss Army, Dr. Zeigler. I saw this ambulance in use by Swiss troops during their maneuvers near Bern, in the Summer of 1893, and was much impressed with its efficiency. Like all other foreign military vehicles, it is unnecessarily heavy, but this defect can be easily remedied in the hands of an American workman. In this ambulance the recumbent patients are loaded at the *side* of the vehicle, and the maneuver can take place on both sides at the same time. Seats for patients who are able to occupy them are placed transversely in the body of the wagon, and iron steps for the convenience of this class of patients are judiciously distributed about the running gear. It has been in service during several campaigns, and was loaned to the Germans, who so fully appreciated its merits they "could not part with it without regret."

It is to this form that I invite the attention of all who contemplate new ambulance construction; for the civil service it presents many advantages of use in crowded thorougfares, and with some interior alterations can be made more convenient than the present form, while for the military service it affords a means of removing the greatest number of wounded in the shortest time and with most comfort to its occupants.

See illustrations and outline sketch-plans of the vehicle on following pages.

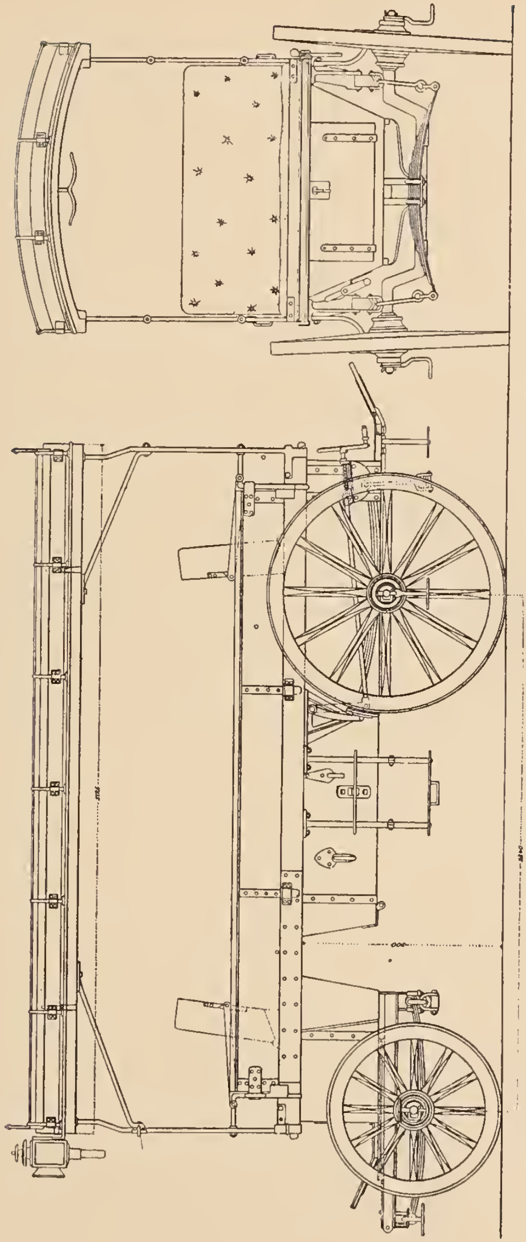


Arranged for twelve men sitting, or six sitting and two or three lying.



Arranged for four or six men lying. The movable left side is lowered. The cushion (B) is ordinarily placed with its base against the shelf (A).

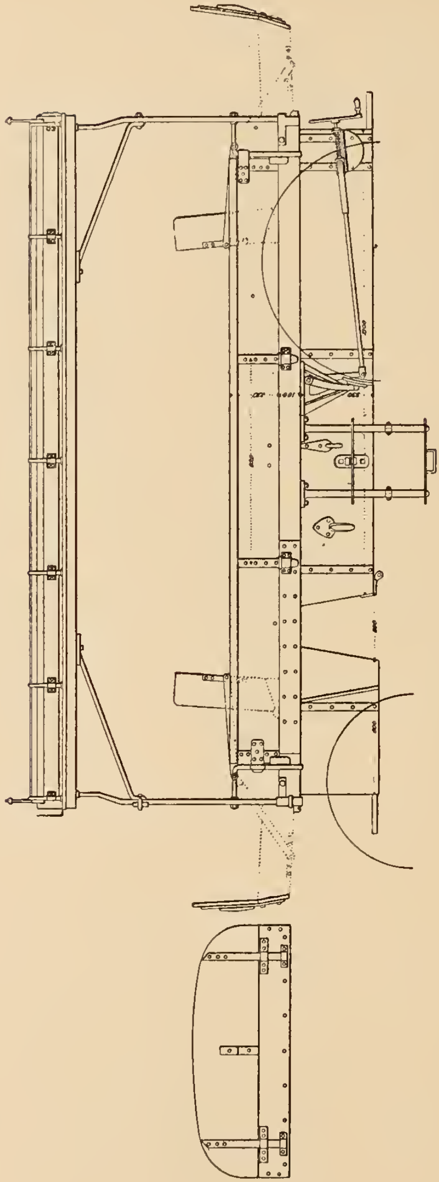
AMBULANCE.



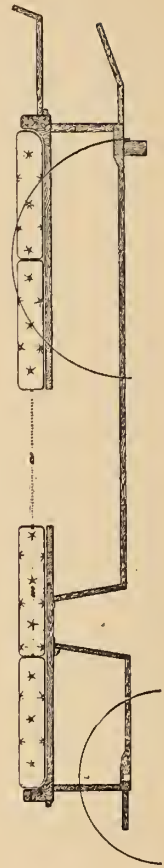
Rear View.

Side View.

AMBULANCE.



Side View.



Long Cut through the Box.

THE RELATION OF NAVAL ARCHITECTURE TO PROPER SANITATION.

BY J. R. TRYON, Surgeon-General, U. S. Navy.

The problem of how to navigate the water was one of the first that appealed to the avarice, greed, spirit of adventure, and love of conquest resident in man. Formed by nature to be in touch with the soil, he found himself restricted to a territory intersected by many water courses, and limited by great seas and greater oceans. The world of history was then relatively small. Its story, beginning with the waters of the Euphrates, and moving rapidly over many years, soon centers on the shores of the Mediterranean, where those races lived that dominated for centuries all the known earth. Placed under smiling skies, with coasts washed by smooth waters for days together, and with islands on every side to shorten voyages and give shelter in time of storm, they found the great sea a constant appeal to extend their knowledge and dominion. To minds tending to all forms of superstition the great unknown waters presented many terrors, and seemed some great monster or god perpetually swallowing rivers, and at times lashing itself into a rage of discontent. But familiarity lessens fear and intelligent experimentation gives self-confidence. Time and effort produced the much-desired results, and from the raft and canoe of inland waters ships were gradually evolved, commerce was born, and the conquest of distant lands became the passion of the time. Thus, early in the history of our planet the human race created a pursuit that involved a separation of man and mother earth, and thus committed him to an artificial environment from which he was too often to suffer disease and early death.

Experience had to teach many lessons in relation to the nature of the medium through which and on which ships move. There was no theory of naval architecture — no application of mathematics

to the complex problems involved. The outcome simply rested upon the great essential in all construction, that the result shall be adapted to the requirements. It, therefore, soon became apparent that the first essential in a ship is that she should be navigable with precision, speed, and comparative safety. A vessel having the same length as breadth, and thus opposing the same form and area to side progress as to forward progress could never be navigated with precision, whatever the propulsion. Even the earliest experiences with the raft and canoe had demonstrated the necessity for a form having much greater length than breadth. The effect of shape upon resistance in relation to speed also evolved, at a very remote period, the pointed or wedge-shaped prow and a limited variety of water line. While weight necessitated a degree of immersion, safety and carrying capacity determined the relation of draft, height of superstructure, and breadth. Such fundamental considerations have operated from the earliest ages and have perpetuated the general resemblance of all ships in all times.

While it is not necessary to bring forward all the essential reasons for the form of a ship, it is desirable to realize that, from the very nature of the work to be performed, sea-going vessels are limited to a certain shape without regard to any consideration of sanitation, and that it is this form, designed for all conditions of wind and weather, all climates, and all seas, that has had much to do with the diseases of sea-faring people. This huge, hollow, spindle-shaped body, half immersed horizontally in water, divided by horizontal and vertical partitions, with few openings connecting its spaces with the outside atmosphere, and crowded with stores, implements of war, and men, has its general design fixed by unalterable conditions and represents simply the structure required by the laws of nature to bring all races together, and thus work out man's ultimate destiny on this globe. A human being placed within a floating body of this shape finds himself confronted with an existence for which he was not designed. His natural relations being therefore disturbed, there ensues a greater or less struggle in the effort to adjust himself to his surroundings. In the end, there is necessarily a certain degree of individual loss, which varies with the power of adaptation. This power depends, to a great extent, upon knowledge and intelligence, through which he can alter his surroundings, approximating them more or less to nature, of which he is a part.

The study of the preservation of life from actual violence and of the destruction of life has always occupied the minds of the human race; but the subtle conditions under which health is maintained and life preserved have not, from their very nature, appealed so strongly to man's sense of self-interest. Those whose lives have been given up to the scientific study of the former consideration have been regarded as men of affairs, leaders of races, and makers of history; while those who have devoted themselves to the latter have found themselves away from the main thought of their age, and consequently more or less deprived of power to utilize that knowledge, second to none in value to mankind. This has been illustrated very strikingly in the history of the sea. Up to a very recent date no ship had ever been constructed in which the question of the health of the crew had been scientifically considered in the design itself, and there have been few after construction in which intelligent effort has been directed to the preservation of health. The great idea in all time has been to sweep the sea — to have dominion over the waters. For this purpose ships have been built as mere engines of war, and with but little consideration for the fact that the most indispensable mechanical instruments are men themselves. Ships were few, and represented much time and money — men were many, and could be easily replaced. And thus for hundreds of years much more anxiety was exhibited in preserving arms from rusting, and cordage from rotting, than in considerations affecting the health of crews.

The story of ship-building, so far as it is related with any definiteness, begins, as has been said, among the people of the Mediterranean. The Phœnicians desired to navigate the sea for commerce, and later the Greeks and Romans for trade and conquest — for supremacy as nations. They studied the problem in their own way, having due regard for the fundamental considerations heretofore presented. On smooth waters, where a vessel with sails might be becalmed for many days together, necessity determined that the principal instruments of navigation for vessels of war should be oars. Oars would allow rapidity of motion and enable the attack on the enemy to be swift, sure, and complete. Naval architecture centered around the arrangement of oars, and every possible expedient was resorted to to give each ship the greatest possible number. As

there was one man to each oar, and as every additional biceps meant increased power, all available space was occupied, so that when a ship was in motion there was not room between decks for another human being.

This necessity for crowding vessels of war with men has existed in all ages, and has been one of the greatest factors in determining the prevalence and intensity of disease. At first it was to get the maximum propulsive power, afterward it was to work guns and manage sails, and now it is to shovel coal and grind out shot, the purpose always being to have a greater force than the adversary at that supreme moment which is the summit of opportunity in a fighting ship. In that day the problem was simply to find the smallest space in which a man with an oar could work, and then shape the ship for the maximum speed and efficiency.

In those early days there was no upper deck and, consequently, the supply of fresh air was unlimited, though the exposure to sun and spray was great. But as naval warfare became more complicated, and its requirements better known, an upper deck became necessary to strengthen the ship for the use of the ram-bow, to furnish a commanding position for the fighting men, and to give some protection to the rowers. But this deck, even when Rome was at the height of her power, was never complete. Gangways extended from the bulwarks toward the mid-line, leaving a wide, open space, surmounted by a hurricane deck, between the supports of which an awning could be placed for protection against the weather. Below the rowers was the deck covering the hold containing cisterns of drinking water and much bilge water. All these vessels were built of timber never allowed to season before being used in construction, that it might be bent into the necessary shapes. As a result the seams were continually opening, and, in spite of caulking and application of tar, the mass of bilge water required the constant use of buckets in bailing, or of a machine consisting of an Archimedean screw, worked by some sort of tread-mill.

In the typical war ship of ancient times there were placed 174 men, arranged in three tiers, in a rowing space of about 15,000 cubic feet. Below them was the hold, with its constantly renewed bilge water, and above was the sky, which could be seen by those rowers in the upper bank. Then there was the mast, with the square yard and

sail, and on each side the many oar ports, closed against the water by leathern bags. Such were the war vessels of the ancients, and in all essentials of the whole world until the Fourteenth century, when the application of magnetic attraction in a practical form to purposes of navigation inspired mariners with confidence and made it possible for them to commit themselves to the trackless ocean without fear.

These ancient war vessels, constituting the navies of the world, show from their very construction, and from the scope of their work, that they were not the homes of such diseases as have made the account of many cruises of more recent times one of suffering and death. They were calculated only for a tranquil sea, and seldom ventured far from shore, or quitted ports at those seasons when hurricanes or tempestuous weather were liable to endanger their safety. Fitted with flat keels and constructed with rather flat bottoms, they were frequently drawn up on shore, and were at no time the permanent homes of men. With enemies near at hand, naval fights were soon precipitated, and after victory the conveyance of troops was alone necessary for the complete subjugation of the most powerful and remote territories. Indeed, for purposes of war, the soldier and the sailor were often the same, as is shown by the invasion by William the Conqueror, whose ships were burned as soon as he landed on the English coast.

But the mariner's compass and the introduction of cannon on board ship made a wonderful change. Then the nations of western Europe filled the Mediterranean with sailing vessels devised for voyages on the ocean, and oars finally gave place to sails, though, as a rule, still holding their own on vessels designed solely for use in that land-locked sea. With the mariner's compass and the introduction of cannon begins the story of sea voyages of discovery and the history of the long struggle with diseases at sea. Prior to that time naval architecture reached the limits of perfection in a few years, so that states that had neglected maritime pursuits were able, on the impulse of the moment, to place themselves on an equality with the strongest sea powers. But gunpowder and the magnetic needle, when the knowledge of them became common, augmented in a wonderful manner the properties of ships, whether for war or for commerce, changed their construction in a great degree, and made them the permanent homes of men. From that time the scene of

maritime greatness shifts gradually from the smiling Mediterranean to the tempestuous Atlantic, and naval architecture moves from vessels with oars to ships with sails. The galleon superseded the galley, and the day of ancient ships was passed. Madeira, Cape of Good Hope, America, and the route to the Indies are names marking this new era in the history of the sea. Shortly after these discoveries the introduction of cannon on shipboard became general, and it was in 1500 that Descharge invented port-holes.

The navigation of the Atlantic, and the use of cannon, with the introduction of port-holes, lead to ships of greater size, higher sides, and many decks. Decks, on the abolition of oars, ceased to be open along the mid-line, communication being maintained by square hatches, which were closed in bad weather. The questions of naval architecture now centered on the greatest amount of sail and number of guns. Toward the close of the Sixteenth Century Spain had vessels of three decks, carrying over 100 guns, and that country was followed in the Seventeenth Century by England, who eventually built ships carrying 120 guns and 800 men.

The era of sailing ships of war begins, then, in the Fourteenth Century. It continues for nearly 500 years, and its story has many chapters of suffering and death incident, in great part, to a faulty construction of the vessels themselves. These old ships were built of wood and had holds of great depth, that they might sail close to the wind. Guns were placed even on the lowest deck, and for many years the port-holes on that deck were within sixteen inches of the water. Communication between decks was maintained by hatches, those leading to the hold being closed except when it was necessary to break out stores. The lowest part of the ship was, therefore, a perfectly dark and unventilated space, and, as the bottoms of vessels of war were not coppered until after 1779, was never free from a considerable amount of water. For many years the air in this part of ships would at times be so foul as to stifle men before they could be drawn up, and, next to drowning, the most common accident peculiar to a life at sea was suffocation from foul air. The necessity for visiting the hold was not infrequent, for the pumps were subject to be clogged with filth, and some one had to venture down in the well to clear them. Besides, until 1815, all drinking water was carried in casks, and each day a sufficient number of

these had to be hoisted for that day's supply. At sea this was frequently the hardest and most dangerous duty of seamen. Next to the violent pressure on the abdomen while lying on yards in furling sails, it was believed to be the potent factor in the production of hernia. It also was the cause of many other injuries, and exposed the men each day to poisonous and, at times, irrespirable air. In the hold, until this century, was also carried gravel, sand, or other earthy substance, for ballast. This retained putrescent matters and was a prolific source of disagreeable odors and disease. In a correspondingly short time the lack of ventilation, the presence of decomposing material and moisture, caused more or less decay in the various stores, and even in the timbers of the ship. This condition of things existed on every vessel of war, and was a marked local cause of discomfort and disease. The utmost distress would at times arise from the decay of water casks on long voyages, and in remote parts of the world, where they could not be replaced. While drinking water, carried in imperfect casks and exposed for months to vitiated air, would generate and absorb various poisons and cause many deaths.

The ships of this period were, in a general way, much like those of later times. Decks communicated by hatches, and contained tiers of ports for guns. To work the guns with which each vessel was burdened men in great numbers had to be provided, so that the living spaces were very much crowded; ports were closed in bad weather for days together, the lower tier being rarely open under any circumstances. As there was at such time no arrangement for the admission of light, the darkness between decks necessitated the use of candles, which further vitiated the atmosphere. Hatches were frequently not placed in line, one below another, so that the lower decks were often deprived to a great extent of the slow, vertical exchanges of air from difference of temperature. Openings on the upper or spar-deck were covered in time of storm, thus shutting off all communication with the outside air. When it is added to this that in the largest navy of the world the supply of soap and fresh water was very limited until 1810 or 1815, and that but few changes of clothing were provided, there is presented a picture of a dwelling place the details of which can be safely left to the imagination. Under such circumstances it can be readily perceived that

the great dangers of a sea-faring life were resident in the ship itself, and that these would increase with the size of the vessel, the multiplicity of decks, and the number of the crew. The larger the ship the greater the amount of sickness and death.

This is well illustrated in the expedition of Hosier to the West Indies in 1726. His fleet consisted of seven ships of the line. It is stated that before his return he buried two crews for each vessel, the causes of death being scurvy, fever, and intestinal troubles. Though this, perhaps, is the most disastrous instance of the baneful effects of sickness in any navy, history supplies us with many others in which naval expeditions have been entirely frustrated by the force of disease alone. Among these may be enumerated Mansfeldt, in 1624; the Duke of Buckingham, in 1625; Wheeler, in 1693; the expedition to Carthagena, in 1741; D'Anville, in 1746, and the French expedition to Louisbourg, in 1757. But prior to all these may be mentioned the invasion of France by Henry V., in the early part of the Fifteenth century, in which, owing to some delay in the embarkation, his army was reduced by dysentery from fifty to ten thousand. Nor is the story of Anson to be forgotten, who, in a cruise of a little more than three years, buried four-fifths of his crew, and had lost 200 men within five months after his departure from home. It was on this expedition that the captains and surgeons of the squadron represented to the Commodore the frightful condition of the air between decks, and the absolute necessity for some change, that the men might be allowed to breathe, and that the ships, which were so deep in the water that their lower ports could not possibly be opened, might be relieved to some extent of the stench increased by the large number of sick. As a result, six air scuttles were cut in each ship in such places as the strength of the structure would allow.

Sir Richard Hawkins, who lived early in the Seventeenth century, mentions that in twenty years he himself had known of ten thousand deaths from scurvy alone, and it is stated that in 1739 the vessels in the squadron at anchor at Spithead stunk to such a degree that they infected one another, and that the men became so dangerously ill from want of air that they were put ashore to recover their health. The English Channel fleet in 1780 was so overrun with scurvy and fever that it was unable to keep the sea after a cruise of only ten

weeks. During this year there were transferred from the fleet to one naval hospital over 5,000 cases of continued fever and nearly 1,500 cases of scurvy. In the same year, in the British West Indian fleet, having a strength of 12,109 men, the mortality was 1,518 from disease alone, and but few of these deaths were due to yellow fever. It was in this same century that the Spanish ship Oriflamma, on her passage from Manilla to Acapulco, a voyage in those days of nearly six months, was found at sea with her whole crew dead on board.

Now, while it is not intended in this partial enumeration to convey the idea that all this sickness and death at sea were due entirely to a faulty construction of the ships themselves, it is very evident that much of it was due to that cause alone, and that nearly all of it was, to some extent, inseparably connected with it. During all this period, up to the beginning of the present century, the great diseases of the sea were fevers, scurvy, dysentery, and diarrhea. While scurvy, on account of its great prevalence, its disgusting characteristics, and its practical abolition from the sea in 1796, has, in connection with its great mortality and its association with some of the most remarkable expeditions in history, attracted the eye of the whole world, typhus fever has been a more grievous and general cause of sickness and death. No one denies that the latter finds its cause in air contaminated by foul exhalations, derived in great part from the living human body, and incident to the crowding of human beings in filthy and contracted spaces. If citric acid be regarded as a preventive of the one disease, soap properly employed may be considered as almost of equal force in the other — the one remedy dating its general use from about 1796, and the other not making its influence felt in the navies of the world until some years later. But the degree of cleanliness, dryness, and ventilation on board ship has had a direct relation to both diseases, and during their prevalence it was a subject of common observation how much more sickly than others some ships were in the same squadron, though supplied with the same diet. While every one admits that scurvy is a disease depending fundamentally upon the absence of certain salts in the food, there is no question that its prevalence and intensity bore a marked relation to confinement in bad air, indolent habits, and depression in spirits, and though not strictly a disease of the sea, found something in the conditions of ship life outside of the question of

food conducive to its propagation. As an example of this, it is stated that as Portchester Castle could not accommodate the French prisoners in 1798, a number were removed to a ship in an adjoining creek, where many exhibited scurvy, though the diet was the same on the ship as on shore, and at the latter place the disease did not appear. Time and again this trouble has occurred on ships when men in garrison have remained free from it, though living on the same diet. In all these instances lack of dryness, cleanliness, and ventilation, and also lack of exercise and recreation, have been a sufficient exciting cause.

The magnetic needle made long continuous voyages at sea possible. It incited man to build huge wooden structures that could withstand the assaults of the ocean itself, and bearing cutlasses and guns, could sweep the sea, and carry fire and sword into distant lands. For a navy consists of all the ships of war belonging to a nation, together with their officers, men, and equipment. It is that part of the fighting force of a country which operates on the water, guarding its coasts, and protecting its foreign interests. It consists fundamentally of a number of movable floating forts of limited size and shape, with a propulsive power resident in themselves. Of all, probably the most indispensable mechanical instruments are men. And yet, for hundreds of years but little thought was given to their care and preservation. Many experiments were made looking to the prolongation of the life of timber, but in regard to that of men the State was either careless and indifferent or too ignorant and economical to seek knowledge. When at last changes in naval architecture did occur, they were based primarily upon the preservation of ships and stores. In all attempts to introduce inventions, designed solely for the improvement of health, there was generally a more or less obstinate resistance, due, to some extent, to a superstitious attachment to long-established practices, and a greater or less contempt for all kinds of innovations.

It is true that necessity, from almost the beginning of sea-going sailing vessels, had caused the introduction of wind-sails, which distributed air when it was least needed to only certain parts of the ship, never reaching the hold, and which were apt to be neglected on account of the difficulty in getting them up, and care in trimming. Besides, the wind-sail could only be employed in mild

weather and was not always of use then, for near the Equator, where fresh air was most needed, there would be many days of complete calm. There were times, too, when for days the atmosphere between decks had been stiffling, that wind-sails would carry down to sleeping and probably sick men draughts of cold air, well calculated to add troubles to those already existing. It was not, however, until the Eighteenth Century that the air we breathe began to be intelligently considered, and ventilation came to be seriously considered. We hear, in 1734, of Desagulier's machine for promoting ventilation by aspiration and propulsion, and about the same time of Hales' ventilating apparatus, which consisted of the employment of wooden bellows, worked by hand, and of Sutton's method of aspiration by heat, in which the supply of air for the galley fire was taken from the hold, to which fresh air was supplied by tubes leading from the upper deck. In all these methods the arrangements were either cumbersome and crude or considered open to other objection, and none of them was generally employed.

Though the need of ventilation between decks was recognized throughout the navies of the world by those having charge of men, to naval architects the evils arising from the presence of bilge water and foul air in the holds of ships were chiefly connected with the durability of material. It was found that the moisture and lack of ventilation tended to the formation of mold and the production of certain combinations destructive to the frames and planking below the water line. In the attempt to obviate this the different ventilating appliances were now employed to a greater or less extent, the Hales apparatus receiving more general attention than the others. This invention was first tried in 1753, and remained in use for nearly half a century. In addition to increasing the durableness of the ships it promoted the health of the crews in a marked degree. The Earl of Halifax, comparing the mortality in the ships on the coast of Nova Scotia, stated that the deaths in ships which were *not ventilated* were, in comparison with those that *were ventilated*, as *twelve to one*. The apparatus was not, however, kept in constant operation and, moreover, was liable to get out of order on account of a lack of simplicity in structure. The admirable invention of Sutton, which was tried on a number of ships with very good results, failed in general adoption because of the inertia of

those in power, and the expressed reason of fear of fire on shipboard it strangely induced. Nevertheless, these inventions emphasized the good effects of fresh air upon the health of crews, and ultimately stimulated to some extent the introduction of air tubes and automatic ventilators.

But about this time the system of ship-building, which had for so many years been obviously defective, began to be improved. As ships were not strong enough to bear the strains to which they were subjected without departure from their original lines and without in a relatively short time admitting an undesirable amount of water, inventive minds had long been seeking some marked improvement in construction. This found expression in 1806 when Sir Robert Seppings undertook, among other marked changes, to fill in the spaces between the frames under the flooring of the hold with pieces of wood caulked and pitched, leaving the higher spaces between the frames in communication, through the inner and outer planking of the ship, with the open air. These changes in construction, though undertaken to add strength and durability, are most important when considered in relation to proper sanitation. The cavities under the floor had long been the receptacles of every variety of filth and vermin. They had been responsible, for hundreds of years, for much of the foul air and offensive exhalations. Their obliteration and the creation of channels to the open air were allowed to supersede all other methods of ventilating the hold, and did inaugurate an improvement in health at sea that can not be overestimated. This change, with the use of copper covering for the bottoms of ships, made a marked alteration in the condition of the hold, improving the air to such an extent that it ceased to be a cause of death by asphyxia.

Shortly after this a new method of ballasting vessels was introduced. The weight of iron tanks, each containing two tons of drinking water, was substituted for the sand and gravel usually carried, and which would remain undisturbed for years. Though the tanks also replaced the lower tier of casks the economy in storage was so great that the daily issue of water became more liberal, and, therefore, personal cleanliness more possible. Another result of this important change was that the injuries at sea became less frequent, for water for daily use could now be supplied by force-pump and hose, the

necessity for hoisting casks no longer existing. The improvement in the storage of drinking water and the other changes indicated caused a marked diminution in the prevalence of continued fevers, and lessened, in a great degree, the mortality formerly incident to naval life.

It was also about this time that glass bull's eyes were inserted into decks and ports for the admission of light in bad weather. This diminished the use of candles in the day time, and lessened, to that extent, the vitiation of air and the consumption of oxygen.

With all these changes may be mentioned one that was far from being unimportant. Formerly, the place appropriated for the sick in a ship of the line was forward on the lowest gun deck. Undoubtedly, such a situation for many years, on account of the dampness, lack of air, and general inconvenience, was in itself the cause of many deaths, but not long after the beginning of this century the sick bay was located on the deck above, where, with better air and easy access to the head for necessary purposes, a great improvement in results was quickly noticeable.

It is worthy of remark that the subject of sanitation on shipboard seems then at least to have occupied, to some extent, the minds of those in authority over the naval affairs of the world. The severe lessons of so many centuries of disease and death were at last producing effect. In this connection, it may be mentioned that it was on January 23, 1805, that surgeons in the English navy were given the same rank and pay as their brethren in the army, and that thereafter the general character and professional skill of medical officers in that service became much improved. Men who had been allowed to enter the navy were required to mend their medical education or be expelled, and candidates for examination were possessed of more extensive information, as the rank and respectability which had been assigned the corps attracted good material. In the year following this change the public instructions issued to naval commanders in the British service contained, for the first time, directions relating to ventilation and cleanliness.

Stricter discipline in matters relating to health, improvements in the medical service, and those changes indicated in naval architecture promoting dryness, ventilation, and cleanliness on naval vessels caused a rapid decrease in sickness. Two ships now were more than

equivalent to three formerly in point of efficient service. Naval hospitals were no longer crowded to their full capacity, for scurvy had disappeared from the sea, and ulcers and febrile disorders had become less frequent and violent. In the English service this decrease was very striking, and throughout the world the story of the sea had ceased to be one continuous chapter of sickness and death. Much, however, still remained to stimulate effort and demand improvement. Continued fevers, intestinal disorders, rheumatic troubles, and particularly pulmonary complaints were still too common, and preventive medicine had still many problems to unravel, some of which, however, remain to this day unsolved. Every ship sailing the ocean soon contained many rotten timbers; all attempts at ventilation had only met with partial success, and men still slept crowded together in small spaces as they do now, and as they probably will do for all time at sea.

It was in 1823 that the presence of pulmonary and rheumatic troubles, and the too-common appearance of malarial disorders and adynamic conditions, especially in the tropics, called marked attention to the too-frequent use of water on the decks of ships. It was the routine, and remained so until a very recent date, for men to begin scrubbing and holystoning decks at about 5 o'clock in the morning, and, with a short interval for breakfast, to continue that occupation for about five hours each day. Seamen were compelled to work in bare feet in tons of water on the spar deck for over two hours each morning, even when the thermometer was below the freezing point, and then were allowed to go to breakfast in wet clothes. After breakfast the lower decks were deluged with water and holystoned for an hour or more. Between decks the outlet for this water was into the hold by two small scuttle-holes cut close to the ship's side. Through these openings there passed each day this mass of water, sand, vegetable and animal matters between the ship's side and lining. It was a common sight in those days to find men after all this exertion sitting around on wet chests, or after a night's debauch, in that time of grog, sleeping in wet canvas clothes on the deck they had just scrubbed. The construction of a ship is such that with this treatment decks can never dry, and in spite of the so-called drying stoves then in use they remained wet until again subjected to the water treatment. In this routine again becomes apparent the ten-

dency in all times to subordinate health to appearances. The rivalry between commanding officers to have the best-looking ship was the mainspring of this action. While the decks were kept white as snow, water and filth were run into the hold, where it was generally allowed to remain, its removal presenting no external mark of approbation, until the increasing sick list or odor demanded its removal. Not only was the dampness between decks exceedingly dangerous to health, but the accumulation of filth in the hold hastened the decay of timbers, and especially in the tropics, where the putrefactive process runs its course most rapidly, made each ship a ready home for various infectious diseases. It has been well authenticated that if two ships shall happen to be cruising together, the one having the greater amount of water between decks will have the larger sick list. This was especially noticeable in the days of scurvy, but is also true, it seems, for all times.

It was at this time that the Perkins ventilator received its most extended trial. The Hales ventilators had gradually succumbed to the common windsail, as they were thought to occupy too much space and demand too much time and manual labor to work them. The Perkins ventilator was somewhat similar in action to the Thiers automatic pump more recently in use, and consisted of two connecting tanks half filled with water placed diagonally across the keelson and connected by valved tubes with the air of the hold and that outside. As a ship would pitch or roll the water would fall in one and rise in the other, and thus air would be taken into one by aspiration and forced out of the other by compression. This automatic arrangement appealed very strongly to the scientific minds of the service and was of no small use. At any rate, this ventilator and the windsail were the best ventilating appliances in use on ships at sea in 1823. They were both of little force in the long days of calms in the tropics, and were generally deficient in continuousness and certainty of action.

The hold has always been, and must ever continue to be, that part of a ship requiring continued care and attention. Being the lowest portion of a vessel it must ever be there that gravity will carry much refuse animal and vegetable material. It is also that part of a ship which is ordinarily in the dark, and where dirt and filth remain out of sight, and for the most part out of mind. It

has presented the most difficult sanitary problems on shipboard, and has been the greatest cause of infection and death. In spite of its position and history, probably no wooden vessel has ever been built in which the most perfect ventilation possible has been sought in the very construction of the ship itself. Ordinarily, a vessel has been built first and then some method of ventilating the hold devised afterward; or, when any such system has been considered in the design it has been poorly carried out or allowed to be defeated by simple mechanical difficulties. Naval architects during all the days of wooden ships thought, for the most part, of the vessels themselves, and but little, it would seem, of their crews, except in a general way. They were not medical men, and very naturally followed the lines of their own profession. It was seldom that medical minds were brought to work with them and, therefore, changes in structure for sanitation were caused very slowly by a general diffusion of knowledge on such subjects.

All wooden ships had an outside and an inside planking fastened to the frames, which were in turn fastened to the keel. The keel would then correspond to the vertebral column, the frames to the ribs, and the planking to the intercostals. The spaces between the frames communicated below with the timbers or covered drainage-channels on each side of the keelson, and it was here that the foul air would naturally leave the hold and find its way up between the outside and inside skin of the ship to the outer air. These natural up-takes were uninterrupted by the decks, which rested below on the shelf running horizontally the whole length of the ship, and had the waterways above. Any opening through the waterways or shelf into any space between the outer and inner planking would, therefore, connect the decks with the hold. Unfortunately, this was not infrequently done under the idea that the heated air between decks would pass up, along with that from the hold, into the outer air. But the motion of the ship at sea would often pump the air from the hold among the crowd of sleeping men. Besides, the natural up-takes for the air in the hold were made nearly useless by obstructions formed by sills of gun-ports and by blocks put in between frames to give stability to ring-bolts used in working the guns. The sill of each gun-port rested on the ends of two frames, and thus completely occluded three channels and, as the ports of

the upper tier were never directly above the lower but between the port-sills in large ships, obstructed the majority of all the communications of the hold with the outer air. Each chock let in for the ring-bolts obstructed still another channel, and so a number of *culs de sac* were formed where decayed wood, mold, and accumulations of filth made it easy for the ship herself to become diseased, and almost impossible to disinfect her and free her from the plague. This condition of things in a greater or less degree obtained in all wooden ships, whether in the days of sail or steam.

Steam began to be used on naval vessels as a propulsive power about 1822. With it begins a new era in naval architecture, and a most wonderful change in the life of the mariner. However, until a very recent date, this power was employed as only auxilliary to that of sails. This was due at first to an incomplete knowledge of the capabilities of the newly discovered force, and to the lack of sufficient ability to construct boilers and machinery suitable for its manipulation. Afterward, as the knowledge of steam engineering increased, sails were retained on account of the tendency of all ages to cling to old ways and customs, and to resent the triumph of the new over the old. Machinery, boilers, and coal were put into sailing ships to be carried, for the most part, as so much cargo or ballast. Sail-power remained unreduced, and the battery practically unchanged. As a result, the crowding on board ship was considerably increased. Not only was the extent of the living space much reduced, but the number of people greatly multiplied by the necessary stokers, firemen, machinists, and engineers. The capacity for carrying stores was, however, also diminished, and the number of days consumed in voyages much reduced. The mariner's compass had pointed the way across trackless oceans for four long centuries, and man had slowly and painfully followed, the sport and plaything of every wind and storm. Steam brought with it both speed and precision, gave motion even to the long days of calm, and shortened in a wonderful manner the unnatural separation of man from the soil. Ports were thus visited more often, fresh food became more common, and recreation and exercise—not incident to life at sea—more frequent. However, with the greater crowding of human beings in ships no additional means were provided for an increased supply of fresh air between decks. Machinery, boilers,

and coal bunkers also rendered the hold more difficult of access for cleaning, and added oil, grease, cotton waste, and other filth to its contents. Concealed and filthy spaces in the lowest parts of ships became more common, the odor of bilge water more general, and the contamination of sleeping quarters more pronounced.

In the days of sailing vessels work was, for the most part, performed on deck in the open air, but now a considerable portion of the crew was destined to work in the engine-rooms and fire-rooms in comparative darkness, below the water line, exposed for hours to temperatures at times exceeding 160° F. This change in the life of sea-faring people has brought with it its own problems, and presents to-day one of the most serious questions in ship sanitation. No life could be more unnatural than that of the coal heaver and fireman on a ship. Working laboriously in confined spaces, subjected to great heat, and breathing an atmosphere containing quantities of coal dirt and other impurities, many of them suffer from sudden exhaustion, organic heart trouble, or a premature diminution of vital powers. As the use of steam has increased, and engines of higher and higher power have been devised, this class of men in a ship's complement has increased, and this subject has assumed greater and greater importance, and become more and more worthy of a consideration it has never received.

When steam was first applied to vessels of war, the energy was exerted upon the water by paddle wheels. At that time the engine-room hatch was naturally in communication with the berth deck, from which a considerable quantity of foul air was drawn by the current ascending from the fire-room. When the propeller came into use, though a slight saving of space resulted, it was considered necessary in many ships to introduce bulkheads between the engines and the men's sleeping quarters. As a result, the sleeping quarters became exceedingly warm, and this, with the accumulation of foul air, rendered sleep debilitating, and lessened the power to assimilate food. In many ships the discomfort was so very great that a considerable number of men would, whenever the weather permitted, resort to the spar deck, and sleep in the open air. This, to a certain extent, relieved the crowded condition of the lower deck, but subjected many of the crew to the excessive dampness, dews, and malarial and other influences incident to many climates. In damp

weather, and also at times in clear weather, awnings were spread in port to prevent water from reaching the berth deck through the hatches, or to protect the men sleeping in the open air. This diminished the movement of air between decks, and thus added materially to the closeness of all parts of the vessel. In addition to this, a ship with anchors down swings, on account of the excess of length over breadth, with wind and tide. It, therefore, happens that even when smooth waters allow the air ports to remain open, the living space is generally deprived of the advantages of the natural cross ventilation considered so necessary in the hospital pavilion of to-day. This same wind, acting on a ship as if it were a vane, covered the whole vessel with the odor of fecal matter from the "head" at the bow, which, from faulty construction, no means of flushing, and very frequent use, it was practically impossible to either clean or disinfect. It is not desired to exaggerate this picture, so common in the days of sailing ships, and so intensified in the wooden steam vessels now passing away. To accommodate the crew, hammock-hooks were placed fourteen inches apart, and the air space for each man on the berth deck averaged about seventy or eighty cubic feet. Ventilation depended upon a row of seven-inch air ports on each side, so near the water that, as a rule, even in port they had to be closed; hatches in the deck, closed or hooded in very bad or wet weather; windsails, frequently not used at sea and untrimmed or without wind in port, and an occasional metal ventilator turned by hand, and frequently placed so low as to be excluded from the uncertain breeze. Much of this situation was, in the absence of artificial ventilation, due, as has been shown, to the fundamental shape of the ship itself.

The problem, in an abstract way, reduced itself to the ventilation of a space by a few openings in the ceiling or top with the natural condition of the outside air colder than that within, and with the occasional aid of an air shaft, cowl, or windsail. The mathematics involved, the method of computation, and the usual deductions are well known. They have, however, been often misleading when applied to ships. The amount of air going into a space in relation to that coming out is by no means a measure of the general circulation in that space, and while it is true that under ordinary circumstances cold air falls and warmer air rises, the result has to be inter-

preted in accordance with other circumstances. Some of these circumstances are that the deck overhead is broken by numerous large beams, which tend to imprison the foul and ascending breath and other exhalations of the sleeper swinging a short distance below, and that sides of ships are divided by knees and numerous projections, and present many corners. With but little motion in these places, the diffusive power of air and the exchange by gravitation are small when compared with its tendency to seek an opening or exit along the line of least resistance. As a result, the measure of the quantity of air supplied to a deck by a windsail, ventilator, or cowl, and of that leaving by an adjoining hatch, are no true indication of the amount of fresh air that is being utilized. The colder air does not become generally diffused, its stream-lines and flow are well defined, and the larger quantity moves to the nearest and largest exit. The eddies produced are not extensive, though the draft is marked, and at times dangerous. A short distance away the vitiated imprisoned air continues its slow exchanges, warmed by the heat of the ship and respiration, and loaded with carbon dioxide and animal exhalations. The same conditions also apply in some degree to simple exchanges through the hatches, the vertical circulation not being a true measure of the lateral extension. But even this important movement becomes much diminished when decks are multiplied, and when, as has often happened, the lower hatches are not placed directly below those above. Air ports would naturally, when open, assist materially in producing a general diffusion, especially when a disagreement between tide and wind in port caused the ship to assume the diagonal of the parallelogram of forces. Unfortunately, however, either the splash of water or the draft of cold air on individuals crowded against them, has, under such circumstances, generally necessitated their closure. Besides, these ports, in spite of the packing employed, frequently leak, and drip-cups have to be provided for the water at sea. Such cups are usually connected with the hold, from which the odor of the bilge and vitiated air have found a ready entrance.

This situation existed at a time when the knowledge of preventive medicine was increasing rapidly, and the microscope, in intelligent hands, was gradually substantiating the germ theory of disease, and leading to a better understanding of the conditions favorable to its

propagation. Computations of the amount of carbon dioxide and organic matter in the living spaces became common, and increased attention was thereby directed to the necessity for improvement. That the problem was either difficult of solution, or its importance not properly recognized by those in authority, is shown by the large number of different appliances contrived, and the few ever adopted. In the majority of these heat itself was naturally utilized, as it was not only on hand, but recognized as the great cause of the natural circulation of air everywhere. Improvements were, however, also made in windsails, cowls, and various ventilators dependent upon natural forces, and much attention was given to the arrangement of up-takes and down-takes. The most noteworthy expedient, however, was practically the revival, after more than a century, of Sutton's idea. This scheme, which was applied to not a few ships in foreign navies, involved the extension of the jackets or smoke-pipes downward in an expansion over the boilers. Air tubes were couducted from various parts of the ship to the space thus created, and through which the hot air from the fire-room ascended. Communication was also made between the limbers and the ash-pits. In another system, jets of steam were used in tubes to create an upward draft. But none of these changes became general, and, in the United States at any rate, the old conditions continued in spite of the most urgent representations of the danger and distress. Even the old routine of submerging the decks in water almost daily remained, and no amount of advice and disastrous experience prevailed against it. Typhus fever was not unknown, various other contagious diseases became too common, and yellow fever found a congenial home.

A fair illustration of the condition of these old wooden steam vessels, some of which still remain, is found in the history of the "Plymouth," as late as 1878–9. This screw corvette was first commissioned in 1869, and therefore fairly represents the faults in construction belonging to this entire period. In four years several hanging-knees, and considerable portions of the decks and outer planking were renewed on account of decay. This is an example of the methods of repairing at that time, and of the difficulties a complicated wooden ship presented in this line. Such parts as were open to inspection received much attention, but the repair of those concealed was largely dependent upon chance or an exhibition of

weakness of structure. During the succeeding cruise much time was spent in warm climates, and cases of zymotic diseases were reported in every month of the year, the most marked occurring in a captain of the hold, who exhibited cramps in the legs, nausea, vomiting, and fever. In a short time the "Plymouth" was recognized as a very unhealthy ship, and in 1878 she became infected with yellow fever. Removal of crew and stores, repeated fumigations, applications of lime, freezing, and paint were resorted to, but on her return to sea from Boston, Mass., in 1879, the disease reappeared without possible re-infection. Then borings and cutting of scuttle-holes disclosed *culs de sac*, bounded by decayed wood, covered with fungus growth, and filled with decomposing filth and refuse matter. No amount of cleaning or fumigation could reach such places. Such spaces have existed in all wooden ships since the galleon first appeared, and under certain circumstances the results have been practically the same.

Another example, selected from the many available, may be found in the old wooden steam frigate "Colorado," which, not many years ago, was considered one of the most powerful and perfect engines of war afloat. It was during a cruise on the European station that several cases of erysipelas were treated in the sick-bay of that vessel. On her return home she was placed out of commission at Portsmouth, N. H., and subjectsd to the prolonged action of disinfectants. After many repairs, and a sojourn of four winters in a cold climate, the ship was ordered to the China station, the writer being one of the medical officers. In the Spring of 1870, during the passage to Hong Kong by the way of the Cape of Good Hope, several patients were admitted to the sick list, with slight cuts and bruises. They were all quartered in the sick-bay, and erysipelas developed in every case. In spite of every precaution, so persistent was the appearance of the disease in that one locality, that an order had to be issued that no man with an abrasion, however slight, should go near the sick-bay. Such instances might be multiplied, but would serve only to add in detail to a picture the outline of which can be readily traced.

The introduction of steam on vessels of war was ultimately destined to exert a marked influence on the prevalence of intestinal disorders. The history of diarrhea and dysentery is one of the

dark chapters in naval life, and, outside of the question of food, was largely dependent upon the quality of drinking water in use. During the whole period of sailing vessels, and of steamers before the use of distilled water became general, it was not unknown for a large number of the crew to be attacked with these diseases shortly after a supply of water had been obtained from the shore. The questions of storage and supply had always occupied much time, and necessitated much care. In many parts of the world water-boats could not be obtained, and the necessary supply was either brought off in the ship's boats or floated off in casks. This work in tropical climates, and often in the heat of the sun, was, outside of the question of injuries, often productive of unfortunate results. Besides, even after so much work and exposure, the water was frequently far from potable, and would seek its own purification by fermentation and putrefaction. An example of this is found in the history of the sloop-of-war "Swatara," at a time when the writer was her medical officer. It was in March, 1877, that the tanks of this vessel were filled at Norfolk, Va., with water from Lake Drummond, supposed to be most suitable for storage on shipboard. In a severe storm off Hatteras, lasting several days, this water was constantly agitated, its fermentation and putrefaction being also hastened by the heat and confinement of foul air between decks incident to a southern latitude and the closure of hatches. Sixty cases of acute dysentery developed in one day from its use, the disease disappearing rapidly when the distiller was employed. Such marked lessons have in time taught the great value of distilled water on vessels of war for drinking purposes, and have led to a general appreciation of the absolute necessity for its general use in the preservation of the health of crews. It is true that the introduction of iron tanks, the appreciation of a greater need for cleanliness, and the employment of a more careful and exact examination into quality caused a marked improvement, but even after such changes there were, at times, more deaths from dysentery on one vessel, in certain localities, than occurred in the whole navy after distillers were generally introduced. This innovation not only abolished the use of casks, but promoted personal cleanliness, improved the condition of the hold, and allowed more room for stores.

Probably the most striking event in the history of naval architecture is the substitution of metal for wood as a material for ships.

Though this dates from about 1840, it may be considered, in our service, as starting with the construction of the "Monitor," in the days of Civil War. This vessel not only demonstrated the advantage of iron over wood for purposes of war, and revolutionized the methods of naval architecture, but also furnished a marked example of how sanitary ideas in ship-building have had their birth. In the fight between the "Monitor" and the "Merrimac" it was found that there was not air in the turreted steamer for the crew, and that the suffocating gases generated by the explosion of gunpowder found their way below and rendered it practically impossible for the men to work. Necessity, therefore, compelled the introduction of some apparatus for artificial ventilation. The old methods in vogue for hundreds of years had been retained even under the new conditions, and, but for the striking exhibition of direct interference with fighting capacity, would have remained for many years longer. In the "Monitor" was placed a rotary blower, worked by steam, and practically similar to the Desagulier wheel of the preceding century. Air was thus drawn from one half of the steamer, through a system of pipes, and forced into the other. Various changes were made in later ironclads of this period; in some the air was drawn down the turrets and forced throughout the vessels, thus rendering them more than ever liable to suffocate the men below in battle, while in others the supply was obtained through armored cylinders and forced out through the turrets.

As an example of the condition of the early ships of the Monitor type, may be cited the history of the "Tecumseh," which was ordered from the North in June or July, 1864, to Mobile Bay. Heavy weather was encountered during most of the voyage, so that there were but few hours, even after reaching the Gulf, when safety allowed openings for ventilation. Upon the arrival of the vessel at Pensacola, Fla., where the writer was stationed, out of the number of those whose duties kept them constantly below, the Chief Engineer and four men were taken from the ship insensible, along with others greatly prostrated by the vitiated air. None of them were in condition for duty when the vessel left for Mobile Bay, yet the Chief Engineer insisted upon being carried on board. He went down with the ship in the fight a few days after.

It was also in the early ironclads that a peculiar disease developed, which, being confined to those vessels, was soon designated ironclad fever. In this affection the initial symptoms were much like those of typhus, but in a short time severe occipital pain was followed by complete aphonia, and this by coma and death. The introduction of ventilating appliances caused the disappearance of this singular disease, and in time these metal boxes, almost entirely submerged, came to be regarded as probably the most salubrious vessels afloat. The mechanical means of ventilation now introduced was not, in spite of this object lesson, generally applied, for even as late as 1880 there was only one cruiser in the United States Navy in which this system was in use.

The Monitor type, the scarcity of lumber in England, the increase in the size, power, and efficiency of ordnance, necessitating greater strength, the economy, and other manifest advantages of iron in ship building, and the improvements in metal working were, however, together with other considerations, and the plentifulness of iron, effecting a general change in naval architecture. In a short time it became evident that the days of wooden vessels were numbered, and then all maritime powers hastened to construct the present engines of war — veritable steel forts — whose history is yet to be made.

In comparing the navy of the present with that of the past, it may be stated that, from a sanitary point of view, the most important changes are closely associated with the difference in material of construction. Iron rusts and wood decays. The one is purely chemical, while the other is vital. The one is a simple process of oxidation hastened by moisture, and probably by electrical disturbances, but, as a rule, entirely independent of vital influences; the other is usually a complicated change—a variety of death—in which complex molecules, formed by plant life, are broken down into simpler compounds through the influence of animal and vegetable parasitic growth. The one is comparable to a slow burning, the other to a putrefaction. A decayed ship is, therefore, much like a dead body, particularly in those parts most subject to bacterial and fungus growth. The difference between the present ship and that of the past is, therefore, in this connection, very evident.

The physical properties of wood and iron also differ in the one being absorbent and full of cracks and crevices for the accumula-

tion of filth, and the other impervious and its pieces capable of a more complete coaptation. These considerations have a very evident and important bearing upon infection, air pollution, cleanliness, and disinfection. Iron is also lighter than wood, strength for strength. This favors increased tonnage, provides more space, and, in lessening the size of beams and knees, furnishes fewer obstructions to the circulation of air. Armor plating of sides and increased weight of ordnance have also caused greater beam and tonnage, and with abolition of sail power have diminished, relatively, the number of men and largely increased the cubic air space per head. But iron and steel have a much greater specific gravity than wood or water even. While every part of a wooden ship would float, the opposite is true of iron. Considerations of safety at sea and in battle have led to the division of a ship, by bulkheads, into a number of water-tight compartments, and to the construction of a double bottom. The latter extends across the bilge and is, of course, absolutely water-tight when the man-hole plates are on. The air between the bottom is, therefore, entirely stagnant, and the space dry, though drainage is provided into wells which could be emptied by powerful pumps. The bilge of a modern man-of-war is, therefore, from a sanitary point of view, outside the vessel, as its air is confined, and it is shut off from the receipt of any refuse material whatever. Yet, now that it has ceased to menace health, no portion of a ship receives greater care and attention, for the question is not one of sanitation, but of preservation of structure—the life of the ship, and not that of the men. Man-hole plates are lifted with regularity, air is renewed by portable ventilators, and men are specially employed to crawl through the space and take care of the metal bottom which seeks to destroy itself by rusting. The old story of the bilge has, however, come to an end, and new conditions haye arisen to confront the sanitarian. But with the growth of knowledge in all parts of the world, the advance in mechanical invention, the rapidly growing insight of medical and surgical minds into the causes of disease, and the more general diffusion of information on matters relating to health, there appears at least a promise of the abolition of the surroundings necessary for the existence of many diseases long considered the curse of the human race.

The arrangement of guns in turrets and in other systems, occupying the former spar-deck, occluding to a great degree its openings and abolishing the old gun-ports, and the division of ships into compartments, creating a number of confined spaces in which men have to sleep and work, have led, from necessity, to the introduction of mechanical means for the withdrawal of vitiated air between decks and the supply of the pure air which has surrounded all sea-going vessels from the beginning. The appliances for this purpose have been so improved that it is now possible, by the use of the rotary fan, to extract from or force into each compartment any desired quantity. The incoming air is, however, not warmed, and this, with the small amount of cubic space occupied by each person, limits the supply necessary for a proper renewal. The question of drafts thus assumes a place of the greatest importance in the problem, and its comparative solution becomes a question of great moment. Besides, the amount of air going into a space and the amount coming out are not a true indication of the general circulation. In this connection it is also apparent that the smaller the number of openings of entrance and exit, the more rapid will be the circulation in certain localities for any given supply, and the less the diffusion. Room for improvement is, therefore, apparent in the direction of increase in apertures—the maximum being the entrance and departure of air through openings as multitudinous as those in gratings, everywhere distributed. The mechanical difficulties are, however, far from small, and considerations of cleanliness would also have to be successfully met. Even now the ventilation of certain spaces is much diminished by friction in pipes, increased by bends. These, and other recognized defects often apparent, lead to the expression of opinion that each important compartment should have its own ventilating system of sufficient power, and that the greatest movement of air compatible with health should be secured by scientific experimentation, made by persons having this duty assigned them. The subject has now come within the range of mathematical precision, but accuracy can only be secured by a regularly organized supervision and a sense of individual responsibility.

The question of moisture on vessels of war has now presented itself under new circumstances. The old contention of wet or dry decks seems to have been definitely and satisfactorily settled the

world over. Knowledge on the subject has at last become the common property of nearly all naval commanders. Great care is now exercised in frequently covering all berth-decks with shellac or other mixtures, and in securing cleanliness with the smallest amount of warm water. But the change from wood to iron as a material of construction has caused new but not unexpected difficulties in this connection. Wood is a poor conductor and absorber of heat. Iron heats and cools rapidly. A metal ship is, therefore, exceedingly warm in tropical Summers, and cold in the Winters of high latitudes. The latter is, to a great extent, controlled by the plentiful use of steam confined in coils, but the skin of the vessel remains exceedingly cold, and to any one sleeping near it, seems much like ice itself. The former is limited by the application exteriorly of white paint, as this color promotes the reflection of the sun's rays. Both are much diminished by an inside sheathing. This has become common in officers' quarters, where bunks are provided, but its continuance is problematical, inasmuch as recent experience in war seems to have disclosed the danger of conflagration in battle. The property possessed by metal of cooling rapidly reduces the power of air in contact with it to retain moisture. As a result, water is deposited in quantity, depending upon the state of the atmosphere and the coldness of the surface to which it is exposed. The phenomenon is known as "sweating," and the condition is one exceedingly detrimental to health. It is true that so long as the condensation continues uninterrupted the air is deprived of moisture, but as the ship is heated by the sun a rapid evaporation ensues, and human exhalations that would have escaped are suddenly set free. Besides, the organic poison from the skin and breath are by this water carried to a certain extent over the ship, inasmuch as the different parts are arranged so as to drain into wells on the upper surface of the double bottom. Fortunately, the presence of water on iron facilitates rusting, and thus excites apprehension relating to its durability. It also, in this manner, tends to mar the clean surface of paint-work, and to destroy the beauty of cleanliness. This has led to the use of paint containing a considerable quantity of cork, the wood acting as an excellent non-conductor. The difficulty, though not entirely met, has been considerably reduced, and promise given that the future has much needed improvements still in

store. This question, however, as has been indicated; is not one confined strictly to the physical properties of the material of construction. The relation existing between the *temperature* of air between decks and this tendency to the deposit of moisture is one demanding more attention than it has ever received. Inasmuch as a vessel of war may be required for duty along the coasts of any country where human beings can live, efficiency will depend, to a great extent, upon the adaptability of structure to rapidly changing climatic conditions. The supply of heat, therefore, assumes a prominent place, especially as upon this depends, in a great measure, whether a ship will be dry and wholesome, or the reverse. It is, therefore, of vital importance that the distribution of heaters and area of heating surface should be considered in connection with ventilation, size of space, and probable or possible variations of temperature of outside air and water. Such attention this subject does not, to say the least, always receive, the desire being too often to free the decks as much as possible from steam heaters, and to leave the supply rather to guess-work and supposed economy of space. It is, therefore, not unknown for a sick-bay and berth-deck to have for weeks an average temperature of 51.5°, with a maximum of 60° and a minimum of 44°. As a result, heavy frost has appeared on the ship's sides and bulkheads, and at times it has been necessary to protect the sick in their cots and hammocks by rubber sheets spread overhead. The effect of such a condition upon health and the determination of disease needs no comment.

Much has been said and written in regard to the treatment of diseases occurring at sea. It would appear, however, that the portion of the ship set apart for the sick has much to do with the result in a large number of cases. The traditions of hundreds of years have fastened the idea that a place at the bow must be devoted to this purpose, though it is the most unfit for the service to be performed. The shape of a vessel and the condition of being afloat render this the point of greatest motion and, owing to the hawse-holes, the one most liable to be flooded by the sea. It is the one place in which air ports must be kept rigorously closed at sea and, barring the engine-room, it is the noisiest locality on shipboard, though even this exception can not be made when the chain rushes through as the anchor goes down or follows the anchor-engine in its rounds.

The effect of the ship's motion on the sick has never, probably, been thoroughly investigated; but, doubtless, in pneumonia and other acute diseases, it tends to paralyze a heart already much weakened. It certainly increases the difficulty in the management of a variety of injuries.

In conclusion, it may be stated that it has not been the intention to treat the subject of naval architecture and ship sanitation in any but a general way. Details have to be worked out from general principles with the aid of individual experience. Valuable lessons may, however, be learned from the history of each subject of importance, and surely even an incomplete study of the causes of the mortality of the sea will not prove an exception. Perhaps the one fact that stands above all others is that suffering, so closely associated with wounds on shipboard during action, and with disease and death, in spite of the irretrievable loss it entails, has influenced but little the minds of men who have built from the beginning the great navies of the world. Changes have occurred from considerations relating to the durability of ships and their perfection as engines of war. The mariner's compass, gunpowder, and steam have each marked an era in ship building, and though the mortality of seamen has been greatly reduced, they each tell the some story of human life depending, so far as naval architecture is concerned, upon the preservation of wood, strength of structure, and conditions evolved during battle. Now the iron or steel age begins. Shall we learn any lesson from the past, or will future ages trace out the same indifference to the life of man? It is believed that such is not the tendency of the time.

The writer desires, in closing, to express his appreciation of the able assistance rendered him in the preparation of this paper, by Past Assistant-Surgeon J. D. Gatewood, U. S. Navy, Museum of Hygiene, Washington, D. C.

AID TO THE WOUNDED ON SHIPBOARD.

By AVERLEY C. H. RUSSELL, Past Assistant-Surgeon, U. S. Navy.

On account of the limitations of this subject it seems to me impossible to avoid the repetition of opinions others have already advanced. I shall not seek excuses, therefore, for ideas in which I may have been anticipated by more competent writers; on the contrary, I acknowledge at once, with pleasure, my indebtedness for the suggestions of those I have been fortunate enough to consult.

It is to be regretted that no details could be had as to the number of the killed and wounded on the Japanese ships, in proportion to the crews, in their recent engagements with the Chinese, and as to the means employed to aid the injured. Such information would give an idea of the practical working of a system for the care of the wounded, which, otherwise, must be largely speculative.

While the provision of a hospital for use during action, and the organization and working of a hospital corps, are not the first considerations in the construction and equipment of men-of-war, their great importance can not be questioned.

The difficulties of the subject have been increased by the complicated arrangements of modern ships.

No system can approach perfection, and we must be content with an imperfect one; still, it is absolutely essential that some system be adopted provided for, and regulated.

The lot of the wounded will be terrible enough in the next naval war, and it will not be improved by insufficient and incompetent aids to the injured, and the killing of the doctors.

On the other hand, proper preparation for the care of the wounded will not only serve the cause of common humanity, but will also strengthen the moral force of the men, and increase their confidence.

As to the medical service on shipboard, in action, all naval surgeons agree on the necessity for, first, places of safety, where the wounded can be received and taken care of; second, convenient means for transporting them; and, third, trained men to handle them.

Here are some of the conclusions of different surgeons upon these points. Medical-Director Admiral J. D. McDonald, of the British Navy, thinks that: "The great diversity in the arrangement of modern war-ships precludes the adoption of definite rules as to the precise locality in which the wounded can be treated; as the space available under any circumstances will be not only limited, but inaccessible from other points, several redoubts in the most accessible localities should be established; the cock-pit in modern ships is below the steel deck, and, in action, as the water-tight compartments have to be closed, a place of safety for the wounded could not easily be found; too much stress can not be laid upon the necessity of establishing local centers of succor; with the exception of what little can be done in the way of first aid, the wounded will have to remain until the action is finished, and then alone can they be satisfactorily attended to."

Drs. Pasquelle and Rosati, of the Italian Navy, are of the opinion that: "Sanitary assistance on each ship should be prepared to correspond with an actual naval engagement; that the personnel should be well drilled in the delicate service of succor and aid to the wounded; during the engagement the medical officer should await the reception of the wounded undisturbed; transportation should be by hand, and by simple means; torpedo boats unprovided with surgeons must rely upon the personnel remaining uninjured; hence, the necessity for general instruction at naval schools, barracks, and on ships, in primary aid to the ship-wrecked and wounded; after an action, ships that have not suffered severely should devote themselves to saving the wrecked, and to transporting the wounded to hospital ships or to sanitary stations on shore; the attendance of hospital ships in modern naval actions is absolutely necessary—this service being provided for by mutual agreement among nations; special sanitary stations should be installed along coasts, to give aid in naval coasting war, and to provide numerous points to which ships may transport their own wounded for major operations."

Dr. Jan, of the French Navy, says that: "With the exception of the 'Mogenta,' for which a protected hospital, to be reached by an elevator, also protected, was designed in 1890, and the Tréhouart, in which a similar arrangement and apparatus were put and tried, the stations destined for the wounded on the other ironclads of the French Navy could not be used. Above the protective deck it matters little where these are placed. After various modifications of stretchers, chairs, and cots, each ship possesses a system specially adapted to the difficulties of her type."

He mentions the stretcher-chair of the "Jean Bart" to note that it has no special advantages, and then sums up the defects of all means of transport yet invented, by saying that they are heavy, cumbersome, slow, under all circumstances difficult to maneuver, and impossible to replace properly when disabled.

Upon the "Formidable," after many trials, every form of cot was abandoned, and the simple stretcher was used exclusively.

For military tops and turrets, certain ironclads, the "Baudin" for example, uses a cot of canvas, which is extremely complicated, and not exempt from danger.

On the "Formidable" hammocks are used in lowering from tops, and chairs of canvas in lowering from turrets.

His remarks with regard to the aids to the wounded on French men-of-war apply, in general, with equal force to those upon our own.

"Whatever system is adopted by a ship a certain number of aids are told off for the transportation of the wounded. On the 'Formidable' there are sixteen stretcher-bearers, and, besides, the two chief quarter-masters and the band-master have the general superintendence of the transportation." But who are these aids? They are sail-makers, cooks and, for the most part, men from the deck, who, never having received any special instruction, can not even conjecture the rôle of a stretcher-bearer.

Does any one think that in time of need they could render the services expected of them? No one can have any illusion on this point.

At present neither the stations, nor the means of transportation, nor the aids for the wounded, correspond actually to the needs of the service.

For new cruisers it is possible to construct a well-protected hospital for use during action, the value of which it is impossible now to appreciate.

The stations for the wounded upon the ships now in commission are below the armored deck, and their small size, awkwardness of situation, deficiency in air and light, and, above all, difficulty of access, render them everywhere theoretical.

It is necessary, then, only to establish posts of succor near at hand, which the wounded can reach easily to receive the first aid, and where they can await the result of the combat.

It is true that these offer no shelter, but it is better to sacrifice a hypothetical protection to the importance of clearing the field of the wounded and of relieving the uninjured of their demoralizing presence, and of the inopportune and dangerous zeal which might prompt them to leave their posts during the fight to give aid, either instinctively or knavishly, to their companions.

In the second place, the removal of the wounded must be quickly done. We must seek, consequently, a means of transport, simple and safe, capable of going through narrow passages, and of being quickly worked and easily replaced, a means by which the wounded can be removed without trans-shipment. Can the hammock be modified to meet these requirements? To work any means of transport trained stretcher-bearers are necessary. Unhappily for the wounded a man is not born a stretcher-bearer.

His is a profession in which is required not only a sufficiently complex technical instruction, but also a certain dexterity that can be had only by practice, and which alone can save the wounded from injuries often irreparable.

I may add that when it is remembered that even on the battlefield, where the conditions are not so complicated as they are on men-of-war, two to five in every hundred of the wounded may die from bungling and ignorant methods of carrying, it becomes evident that the formation of a corps of trained stretcher-bearers on our ships is a matter of necessity."

I have quoted thus at length the opinions of Doctor Jan, because it would be impossible to present the subject as it relates to our own Navy in a more pertinent way.

With regard to the three important points of the question, where shall the wounded be cared for, how shall they be transported, and

who shall aid them, I shall examine the conditions that exist on the ships of our Navy, and then try to deduce some generalizations applicable to them all.

It may be stated at once that in none of them is there a place of safety to which, during action, the wounded can be transported for treatment.

If such places exist below the protective deck, I have not been able to learn where they are and the names of the ships fortunate enough to possess them.

In the construction of our ships no thought whatever has yet been given to the provision of battle-hospitals. If there are any spaces below the protective deck, which might be taken for such a purpose, they are too small, inadequately lighted and ventilated, and, above all, inaccessible.

Take the "Maine," for instance, as a type of our ironclads, and the "Terror," as an example of our monitors. Below the protective deck on the "Maine" there is only one place to which the wounded might be taken, even in theory, and that is the starboard side of the dynamo-room, just aft the passage leading forward to the ten-inch gun turret.

A hatch in the berth deck three feet ten and three-quarter inches long, by two feet six inches wide, opens into this room, and it is reached by an almost perpendicular ladder. In the part of it mentioned, about eight men could be laid on their hammocks spread out on deck. This shows that it is just about large enough to accommodate the wounded among the men stationed in the turret.

The room below the protective deck, above the magazine for the after ten-inch guns, could be used for the wounded of the crew of the after-turret, but for no one else, as access to it during action would be cut off by the trolleys for the ten-inch ammunition running under the hatches opening from the berth deck to the passage in front of it.

So I may say that, on the "Maine," places of safety exist only for the wounded in the ten-inch gun turrets. This is true, also, of the battle-ships "Oregon," "Indiana," and "Massachusetts." On our ironclads, therefore, we may leave places of safety for the wounded out of the question.

In the "Terror," any convenient places below the main deck may be used for the wounded from the turrets; the difficulty will come

in providing for the injured on her superstructure and in getting them below. The men for the guns on the superstructure, including two men in the top, number about twenty in all. During action the main-deck hatches outside of the superstructure will all be closed. Access to the superstructure deck can be had through a narrow hatch in the center, half of which will have to be used for the passage of the ammunition for the secondary battery. The half that could be so used is four feet long by two feet one inch wide. There is another hatch in the superstructure deck above and just in front of the hatch in the main deck forward the after-turret. This is five feet two inches long by two feet eight inches wide. It will also be used to pass up ammunition.

The hatch below it in the main deck is the only opening by which the wounded can be taken below, and has facing it at right angles, at its lower extremity, the side of the after-turret. The narrowness of this passage and the angle thus made in it render any sort of stretcher for getting the wounded below out of the question. They would have to be taken down by hand. Our cruisers, whether protected or armored, have no places below their steel decks to which the wounded can be transferred in action.

On the "Columbia," the "Minneapolis," and the "New York," for instance, there are no places that could be so used. Every existing space is fully occupied for other purposes, and they are reached by small hatches and by ladders, usually perpendicular. On the "Baltimore" and the "San Francisco," I believe, there are spaces under the ward room, which might be designated to receive the wounded. I have not been able to examine these ships personally.

It is necessary to reiterate, then, that upon our ships, with the exception, possibly, of the monitors, the idea of places of safety for the wounded must be abandoned, and the question must be considered independently of any such provision.

Under the conditions of real warfare on shore, dressing stations are put, if practicable, out of the line of fire, and medical officers who sacrifice themselves and the men of the Hospital Corps by working within the zone of a shower of bullets will be thought grossly incompetent.

As things now stand in our Navy, it is quite possible that in an engagement one or more ships may have all their surgeons killed or injured, leaving them without any one to attend the wounded.

How shall the wounded be transported? Chairs, jackets, hammocks, cots, ambulance lifts, and stretchers have been devised and used for this purpose; they have been carried also by hand.

In my opinion, no one form of transportation is adapted to any purpose under all circumstances, as the conditions vary so, even in the same ship. A method may be good in one case, but injurious in another, practicable in one instance but impracticable in another. As to the method used, circumstances must decide; preparation may be made for more than one on each ship.

The indications to be met are carrying horizontally, that is, along the same deck, and lowering and hoisting horizontally, or obliquely, or vertically.

It may be noted that a certain number of the wounded, about half, will be able to walk, with or without assistance, to the aid stations.

In carrying along deck, the patient will be in the position of sitting, or of lying down, practically; and in lowering and hoisting, in the position of standing, or of sitting, or of lying down, according to the means used for transportation and the hatches passed.

To carry horizontally, without apparatus, the method known as "by the extremities," seems best adapted for ships, though it is not applicable to severe injuries of the lower extremities.

One bearer stands by the patient's head, another between his legs, both facing toward his feet. The rear bearer, having raised the patient to a sitting posture, clasps him from behind around the body under the arms, while the front bearer passes his hands from the outside under the flexed knees.

In this way narrow and angular passages may be traversed, and it is easy for the patient and for the bearers.

Taking everything into consideration, it seems to me to be the simplest and quickest method for removing the wounded to aid stations, during action, from the guns, and for carrying them to hatches for lowering or hoisting.

It is true that the patient is virtually in a sitting position, and this, with the method of carrying, tends to increase shock and pain, and to cause syncope.

Though these objections should be mentioned, they should not cause us to discard a means at once so good, so simple, and so gen-

erally adapted for use in action—an emergency that will not permit us to be too particular as to the methods we employ.

One bearer may carry a patient in his arms, or across his back, if the patient be unconscious; or astride his back, if he be conscious.

Patients may be carried also by the two-handed, the three-handed, and the four-handed seat, but only through passages in which three men can go abreast.

With apparatus, some form of stretcher must be used. It has been proposed to put the patient on a mattress in a hammock, and drag him along the deck, instead of lifting him on a stretcher and carrying him.

In either case the patient will be nearly or quite in the prone position, so that unless this is in some way changed, which would necessitate additional handling, any passage or angle that a hammock could go through a stretcher also could traverse. There will be many cases for which a stretcher will be almost indispensable.

Any stretcher to be used in action must be simple, cheap, and easily replaced.

There are two ways, at least, of providing such a stretcher; one is to make the regulation hammock so that it can be used as a stretcher, and the other is to furnish to each ship a certain number of canvas stretchers.

The hammocks supplied to the men could be woven wide enough to allow for a hem along each side, four inches in width, to form sheaths for poles of wood. These lateral hems would be no more in the way than the terminal ones are now. The clews could be so attached as not to interfere with the insertion of the poles, which should be just long enough to allow them to be firmly gripped at the ends. As there would be no cross-pieces to these hammock-stretchers, the poles could be approximated to facilitate their going through narrow passages.

With this arrangement, the number of poles might be limited according to the number of bearers; the number of hammock-stretchers would be equal to all emergencies. My idea is not to use the same hammock-stretcher for more than one man.

During an action the wounded could be carried on these hammock-stretchers to the aid stations and there laid in the stretchers on mattresses on deck. So situated, they could receive first aid.

The bearers could take the poles away with them, using each time a new hammock-stretcher and leaving it in turn with the patient. After an action the wounded could be placed in the same hammock-stretchers on Gorgas cots and lowered into boats. When hoisted on board the "ambulance ship," in the cot, poles could be inserted into the stretcher and the patient conveyed to the place destined for him. In this way the actual handling of an injured man could be diminished, as he would take his stretcher along with him.

The mattress is not to be used in the hammock-stretcher; it is to be put at the aid station, and on it the patient is to be laid in the stretcher. Two men can place a patient on such a stretcher, as follows: The hammock, without the poles, is laid at the patient's head in a line with his body; one bearer crumples the end next the head so as to shorten the hammock about half its length; while the second bearer, standing astride the head, lifts the patient, the first pulls the crumpled part as far as the buttocks, leaving the smooth part beneath the head, shoulders, and body. The second bearer, laying the patient down, advances and lifts the hips and the first pulls the crumpled end of the hammock beneath the hips. The legs are then lifted, and the hammock is straightened out beneath the patient. The poles are then inserted. It takes much longer to describe this process than to carry it out in practice.

Four men are usually required to place a patient comfortably on a stretcher. In this way it could be done safely and quickly by two men, and with very little disturbance of the patient. The rolling of the ship would not be so apt to disturb the procedure as it would be if the patient were lifted entirely from the deck.

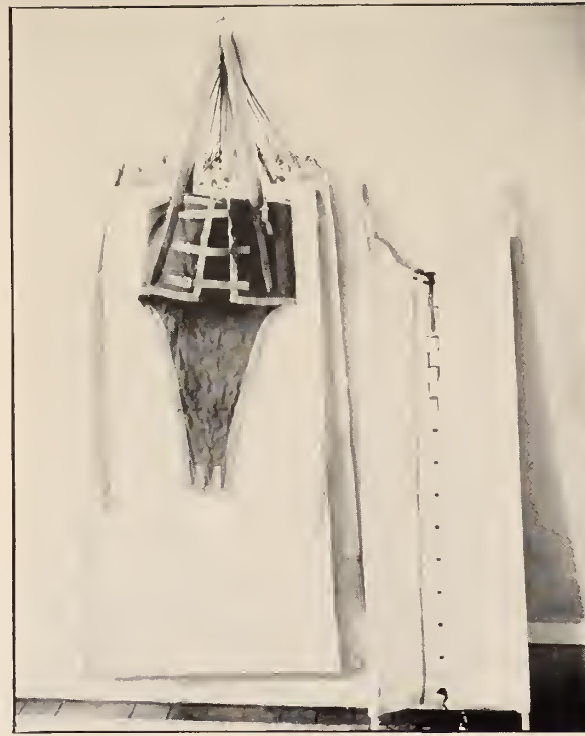
If it should be thought inexpedient to adopt the hammocks used by the men for use as stretchers, canvas stretchers, prepared as suggested, might be furnished for each ship, the number to be in proportion to the crew.

Such stretchers should be seventy-two inches long, twenty-four inches wide, including a sheath on each side four inches wide. The poles should be made of hickory or of ash, six inches in circumference and seventy-six inches long. I do not see, however, how the changes suggested for the regulation hammocks would interfere in the least with their neat appearance or with their ordinary use. An

illustration of a divided canvas stretcher attached hereto explains its construction. The patient can be laid in the jacket stretcher, to be described, or on his mattress in this stretcher. The leather strap can then be pulled out and the halves of the stretcher removed without disturbing him. The dimensions of this stretcher and of its poles would be the same as those for the plain canvas stretcher and its poles. Two men can pass the strap through the central loops, place a patient on the canvas, insert the poles, and lift in two minutes and a half. A number of such stretchers could be furnished each ship, along with the plain canvas stretchers.

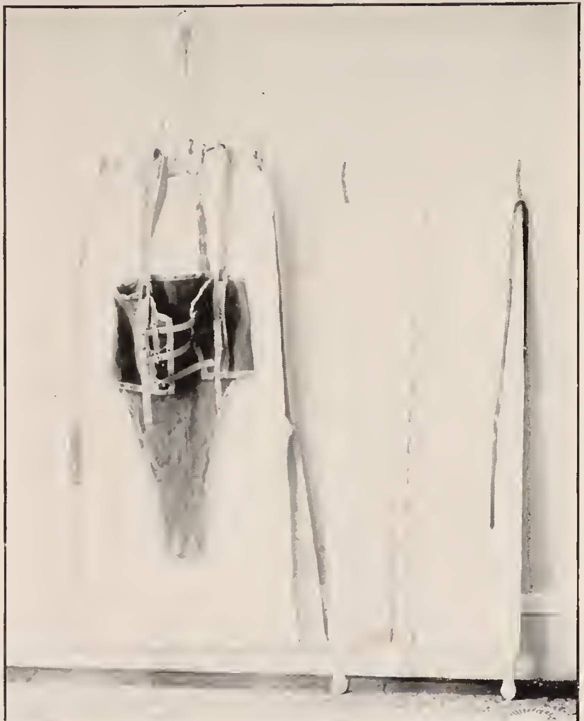
In lowering and hoisting the wounded the conditions are practically the same, so they may be discussed together. The position of the patient will be either that of sitting, or of standing, or of lying down, according to the means employed and the hatches through which he must be passed. For lowering or for hoisting, the horizontal position is at the same time the most rational and the most surgical; but this position is not possible, as a rule, on our new men-of-war. On the "Maine," for instance, the only hatch through which a man could be hoisted on a stretcher, horizontally, is almost entirely surrounded by a wooden bulkhead on the spar deck. Through the other hatches in the spar deck and in the superstructure deck a wounded man would have to be lowered or hoisted obliquely, and through all the hatches in the berth deck vertically. From the engine-room and fire-room men would have to be taken almost, if not quite, vertically. Some means must be sought, therefore—simple, expeditious, and as safe as circumstances will permit—for lowering and hoisting men obliquely and vertically, not only in war, but also in peace. As our ships are now constructed, however dangerous these positions may be to a large number of the severely wounded, they can not, in the majority of cases, be avoided. Taking them, then, as they are, I do not think any form of hoisting or lowering, by rope and pulley, will be practicable during action, for the following reasons: It requires a complicated apparatus and too many men; it groups them so that several or all may be killed at once; it renders the wounded man liable to be dropped to the deck or to the hold below by injury to the rope, or to the pulley, or to the men; the chair, or hammock, or cot may be swung against the hatch or against stanchions by the rolling of the ship unless well steadied by perpen-

No. 1. Patient suspended in "Lowmoor Jacket."



No. 2. Hammock with "Lowmoor Jacket" attached. Patient is to be buckled in Jacket and leg strap to be fastened. The hammock and mattress to be closed around patient with one or two turns of lashing, as in No. 1.

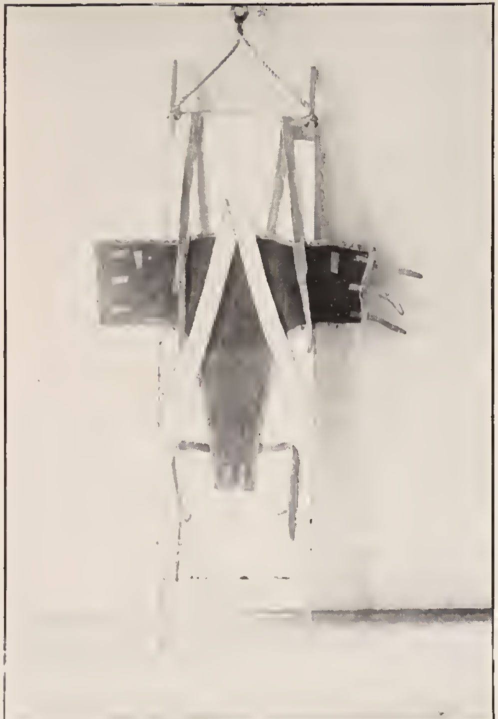
Divided Stretcher, closed. When patient is placed on mattress in this stretcher the strap in the center is pulled out and the two halves removed. Extra handling is thus avoided.



No. 3. Hammock with "Lowmoor Jacket" attached to clews. * Thin cotton mattress attached to clews above. + Hammock.

Divided Stretcher, opened. * Strap to hold loops together in center. + Strap to be tied to these loops.

No. 1. Patient suspended in "Lowmoor Jacket" and hammock. Suspension straps of Jacket are passed through ring of hammock.



No. 5. "Jacket-Stretcher." * Thimble for attaching suspension rope. + Canvas cleats to hold "Jacket" to stretcher. ' Strap to fasten around legs.

No. 6. Patient fastened in "Jacket-Stretcher," ready to be sent below on slide.

dicular guides, or by ropes from below; the knowledge of these facts unnerves the patient and adds to his sufferings.

Under ordinary circumstances four men can take an unconscious patient down a moderately steep ladder by hand. Is it reasonable to suppose they could be relied upon to do this during the excitement of an engagement when the decks and ladders are slippery with water and blood? On this account, and from the rolling of the ship, bearers and wounded would frequently tumble in a heap to the deck below. To me, carrying the wounded below, or bringing them up by hand, seems, under such circumstances, out of the question. Even if possible, it would be sure to increase the death rate.

For lowering and hoisting on board ship, the "Lowmoor Jacket" seems to me to be the best apparatus yet devised. (Fig. 1.) It is true that the principle involved is not new. (Figs. 2 and 3.) For confined spaces, in which the space will not allow a stretcher in a horizontal position, the "Lowmoor Jacket" can be used with the stretcher, and in this manner an injured person can be safely placed at any angle. In hoisting those wounded in the turrets from below the protective deck, this apparatus can be employed. The "Lowmoor Jacket" alone, or with a hammock, is a good means for hoisting from fire-rooms or lowering from tops. (Fig. 1.)

This jacket is, roughly speaking, T-shaped, and adapts itself to men of different sizes. The "arms" of the T surround the body, extend from the axilla to the waist, and are fastened together in front by three leather straps and three buckles. The "leg" of the T passes beneath the crotch. Two straps, stitched to the whole length of the back of jacket, leave the upper part of it opposite the axilla, from two loops above the head and, coming down in front of the shoulders, are fastened, each by one strap to a buckle on the "arms," and by another to a buckle on the end of the "leg." The whole is suspended by the loops above the head.

I am aware that the jacket is open to the objections that it may press too much on the axilla, or on the crotch, and that it requires for its use the integrity of the shoulders or of the crotch. In actual service, however, it seems to work well, and men suspended in it for several minutes have not complained that it hurt them. I do not claim that it is a perfect apparatus, but I do say that I have not been able to find a better one. Will any one show me a method of transportation with which fault can not be found?

My idea is to use the "Lowmoor Jacket" with a stretcher, for the purpose of passing the wounded from one deck to another. The stretcher thus formed will possess the great advantage of having no loose parts. (Figs. 5 and 6.) The stretcher is to be two feet wide. The poles, of seasoned hickory, are six feet eight inches long, with the ends turned into rounded knobs. These are joined by bars of steel six feet apart. Over the poles and the bars canvas is tightly stretched and sewed. From the upper corners the canvas is cut away sufficiently to allow the suspension straps of the "jacket" to be passed over the bar, which is covered with leather to prevent chafing.

At the junction of the poles and the bars at the upper end, a rope strong enough to suspend two hundred and seventy pounds is spliced. A loop of rope is thus made, and in a turn in its center a "thimble" is sewed. In this "thimble" the double hook of the lowering or the hoisting-rope is caught. (Figs. 5 and 6.) A "Lowmoor Jacket" is laid on this stretcher and secured to it by two canvas cleats at the sides. These hold it in place and allow it to slip up and down, to adapt itself to men of different heights. Fixed to the lower part of the stretcher is a strap to buckle across the legs below the knees. This jacket-stretcher is to be allowed to slip down from one deck to another on a skid or slide, with raised sides of sufficient height to prevent the stretcher from slipping out of it. These slides are to be made on board ship to fit certain hatches selected for their use, to which they are to be fastened by hooks, exactly as the ladders are. They should be made of ash and a little more than wide enough to hold the stretcher. They can be stowed near their hatches. On these slides the loaded jacket-stretcher is to be slid to the deck below, the bearers on the deck above regulating its descent by a rope hooked into the thimble. Two men can lower one in this way and, if they should be shot, or the rope cut, the patient could only slide in the stretcher out on the deck below; he would not be dropped several feet.

The improved "Furley" pattern stretcher can be used with the "Lowmoor Jacket" to send the wounded below on the slides. (Fig. 7.) On the "Maine" such stretcher slides could be worked at the hatch in the middle superstructure-deck between the smoke-stacks, at the two hatches in the main deck under the middle superstructure, and at half of the main deck hatch beneath the forward superstructure.

Supposing the slide to be shipped at any of these hatches, it would require at most five men to work the hammock-stretcher and the jacket-stretcher, two to bring the patient to the hatch in the hammock-stretcher, two to receive him below, and one to assist in lowering him and to pull up the jacket-stretcher again when unloaded. This would leave the two bearers that brought the patient free to go at once for another.

If, in a hot engagement, it should be thought advisable to lower the wounded below the spar-deck, it would be best to discard every form of stretcher, to carry them to the hatches by the extremities, and to place them in the jacket-stretchers for passage below.

During an action with forts, in which a ship would not be frequently struck, there would be time to carry the wounded properly on plain, or on divided, canvas stretchers.

In the jacket-stretcher the wounded can be hoisted vertically through the hatches of the protective deck. The "Lowmoor Jacket" can be attached to an ordinary hammock by passing the suspension straps through the upper ring before fastening them. A thin cotton mattress can first be placed in the hammock, and fastened to the clews above. After the patient is buckled in the jacket, the hammock and mattress can be secured around him with two or three turns of the lashing.

Thus protected, he can be lowered through a military mast, or hauled up out of a fire-room. The jacket can be used alone for these purposes. After an action the "Boatswain's Chair" may be used for hoisting some of the wounded from below the steel-deck.

Who shall aid the wounded? The aids on our ships are, as a rule, one man from each gun's crew—say about sixteen on a ship like the "Columbia." These men have other duties at guns, chiefly to pass ammunition. There are, besides, one or two from the powder division, and a few from the marines; they, also, have other duties to perform when *not actually engaged with the wounded*, so it may be said that they are expected to perform double duty.

Generally speaking, they have but little conception of the proper way to handle the wounded, and what aid they might render the wounded during action could only increase their sufferings and the death rate. Besides, the complement of men on a ship is usually reduced, by various causes, below the number required by the drill

book, and even these mentioned could with difficulty be spared for ambulance work. It seems imperative, therefore, that a permanent Hospital Corps should be created for our Navy.

The men for this corps can be selected for special aptitude, on receiving-ships and at barracks, and can there be instructed and drilled in their duties. For this purpose drill regulations suited to the conditions on shipboard can be used. When familiar with their duties a certain number of them can be sent to each ship, in proportion to her complement.

Dr. Palasme de Champeaux, of the French Navy, estimates that a set of two stretcher bearers must be allowed for each 100 combatants, or important fraction of a 100. For ordinary ship work the Hospital Corps could be assigned to different divisions, and given the lighter kinds of work.

They should be distinguished by some mark on the sleeve. At drill, and during action, they should wear on the left arm the red cross on a white band, now used for the sick. When exercising, and in action, they should be provided with shoes with thick, corrugated rubber soles, to make them more sure-footed on the decks rendered slippery by water and blood. They should be taught bandaging, especially the "triangular" bandage, and its application; the difference between arterial, venous, and capillary bleeding, and the various means of arresting it; the signs of fractures, and the first aid to be rendered in such accidents; the application of splints, or other restraining apparatus; first aid to those suffering from different kinds of wounds, from collapse from injury; to those stunned; to the apoplectic, epileptic, and fainting; the immediate treatment of the apparently drowned, or otherwise suffocated; the treatment of burns, scalds, and poisons; the application of first dressings, improvised methods of lifting and carrying the sick or injured; methods of carrying the sick or injured by hand, and on stretchers, and of hoisting and lowering them on shipboard.

It will be seen that, to comprehend and apply such instruction, intelligent and capable men will be required. Suitable instruction in these matters should be given the cadets at the Naval Academy, the apprentices at the training station, and the men, generally, on shipboard.

In many instances, during war, the officers and the men will have to be for a time their own surgeons and, after an action, the doctors

will not be able to superintend the transportation of the wounded. At the close of an engagement, as many of the crew as are necessary can be detailed to aid the regular Hospital Corps.

The first-aid dressings should be hung on the bulkheads at the aid stations, at those of the stretcher-bearers, and in many other parts of the ship, in bags. The side of these bags next the bulkheads should be made of canvas, or of wood, and the other side of coarse netting. Through the meshes of this netting the bearers can see the materials within at a glance, and so will not be obliged to fish what they want out of the depths of a box, or of a dark bag.

An antiseptic packet should be given each of the men, and they should be warned against infecting wounds with their fingers, and told the advantages of hermetically sealing them when possible. With the conditions I have indicated fulfilled, the service for aiding the wounded during action might be arranged as follows on the "Maine:"

A slide should be shipped in the hatch of the superstructure-deck, between the smokestacks; in one or both the hatches of the spar-deck, under the middle superstructure and, possibly, in the hatch of the spar-deck, under the forward superstructure. The commanding officer's quarters would have to be used for the wounded from the after six-inch guns, and the after superstructure. A jacket-stretcher should be placed in the slides of the hatches selected, ready for use, and held there by the rope hooked in the thimble by a snap-hook. At each hatch one bearer should be stationed, to tend the stretchers, and to aid in lowering the wounded.

There should be three medical officers, and a Hospital Corps of at least three to each 100, or important fraction of a 100, of the crew. One surgeon should have charge of the spar-deck and of the superstructure-decks, and two should be stationed on the berth-deck, one forward and one aft. The apothecary and the bagmen should be with the surgeons on this deck, where stations for the wounded could be arranged in the sick-bay, the chief petty officer's mess-room, the engineers' workshop, and the spaces forward the port torpedo tube and aft the starboard torpedo tube.

One stretcher-bearer might be stationed in the dynamo-room forward, and another in the room over the after ten-inch-gun magazine. The relief crews could aid them in caring for the wounded in the

turrets. The other stretcher-bearers should be divided and conveniently stationed on the two decks. If the wounded should be sent below, two bearers should receive them at the foot of each slide, and take them out of the jacket-stretchers.

The hammocks to receive the wounded should be unlashed, opened out, and piled up ready for use at the selected stations. Upon these, on deck, the wounded should be laid. Stretchers should be in readiness, on each deck, for those too severely injured to be carried by hand. Netted bags containing the dressings should be placed at the stations for the stretcher-bearers, and at numerons convenient places throughout the ship.

During a bombardment the ship would not be very frequently hit, and the wounded could be sent below to the berth-deck in the jacket-stretchers. In a point-blank engagement of short duration, this, if at all possible, would be of very doubtful utility, as the injured would be no more protected on the berth-deck than on the spar-deck and, consequently, the additional handling would be an unnecessary aggravation of their sufferings.

It would be desirable only to get them out of the way of the guns, and out of the sight of their companions, to convenient places where they could receive first aid, and await the result of the combat. In an action lasting several hours, the cases requiring immediate operation should alone be sent below.

What shall be done with the wounded after an action? This question brings me to the consideration of "ambulance ships." Such ships must exist, and must be recognized by nations for future naval wars. There are two ways of providing such ships. One way is to charter and adapt very swift merchant steamers, capable of following our fast cruisers; the other is to build "ambulance ships" out and out.

When it was thought, recently, that the United States might be involved in war with Chili, provision was made for chartering a merchant steamer, and fitting her out as an "ambulance ship." As we have no hospital transports, it seems to me that it would be wise and humane on the part of Congress to make an appropriation for the construction of one "ambulance ship," which could be especially adapted for the care of the sick, wounded, and shipwrecked, and could contain every needed modern surgical appliance. In time

of peace such a ship could be used as a training-ship for the Hospital Corps, and as a hospital. She could take part in squadron evolutions, to practice the crews in transferring the wounded to her at sea.

In case of a sudden war we should have at least one "ambulance ship" ready, with the working of which the service would be familiar, and which could be used as a model for constructing or transforming other steamers. Besides her medical and surgical outfit, she should be provided with electric search-lights, to enable her to work at night as well as in the day; with all the best life-saving apparatus known, and the most approved boats and means for transferring the wounded. She could carry additional medical and surgical supplies and, besides a sufficient surgical force, extra surgeons to supply those ships whose medical officers might all be killed, or *hors de combat*. She could follow the squadron, to receive the wounded after an action, either for treatment on board or for removal to hospitals on shore. In the latter case, urgent operations could be done en route. With an "ambulance ship" at hand it would not be desirable to send the wounded from the spar-deck to the berth-deck on the "Maine." It would be better to leave them at the stations on the spar-deck till after the action, ready to be transferred. This, however, would have to be left to the judgment of the surgeons.

I am indebted to Mr. James Creelman, war correspondent of the New York World, for the following interesting account of how the matter of aid to the wounded was handled by the Japanese Navy during the so-called battle of the Yalu River, which, in reality, took place thirty miles from the coast. I shall quote his own words:

During the engagement, which did not occupy quite five hours in all, the Japanese surgeons attended the wounded just as they did in the army, sometimes dressing the injuries on the gun-deck and sometimes having the men removed to quarters below. Each ship of the standing fleet was provided with hospital quarters, to which the wounded were removed as fast as possible. The fleet was accompanied by a splendid fast passenger ship, of the Nippon Yusen Kwaisha (Japanese Steamship Company), which was fitted up as a hospital.

At the close of the action the wounded were transferred to this vessel, thus leaving the fleet free to re-engage the Chinese fleet in the morning, as Admiral Ito expected to do at Wei-ai-Wei — without being embarrassed

by the presence of sick and dying men. Indeed, it is the policy of the Japanese commanders, both on land and on sea, to remove out of sight as soon as possible everything tending to depress or discourage the fighting men. During the "battle of the Yalu" the Japanese cruiser Hiyei, which was forced to pass between the two Chinese ironclads Tuigyuen and Chen-yuen, suffered great losses, but she managed to transfer her wounded, in small boats, to the hospital transport, and resumed her place in the main squadron, using her guns until the end of the fight.

The Japanese surgeons worked hard all through the fight, and many of the wounded men were able to return to their posts before the close. The navigating officer of the Akagi, a very small Japanese cruiser, was wounded in the face and arm while commanding in place of Capt. Sakamoto, who was killed at the first fire almost. The Lieutenant retired, but the surgeons put him in condition to resume his place on the bridge, and save his ship from the enemy, the most skillful and daring feat of the action. * * * You will remember that the patient lies on the deck, not in a bed, so that almost any part of a ship can be rapidly turned into hospital quarters.

Mr. Creelman could not tell me the means used for transporting the wounded during action. To Surgeon C. U. Gravatt, U. S. Navy, of the Charleston, on the Asiatic station, I owe the following:

Your conclusion is right regarding actual practice aboard ship in time of action. Tackle, chairs, cots, and the like are well enough for dress parade, but of no use in battle. The Japanese found this to be the case, and discarded them, taking the wounded below by putting them on the backs of other men, much as they are in the habit of carrying children. The ward-room was used as an operating room. The Japanese have much the same preparation as we have for action. They are thorough in everything, their Medical Department is well equipped, their men are clever and up-to-date in antisepsis, and their nurses are *all trained for six months before being sent in service*; not only so, but they have an abundance of them. You may confidently assert that in no country is a wounded man taken better care of than in Japan.

I am aware that the means I have suggested for rendering aid to the wounded during action are incomplete and open to many criticisms. I can only say that in writing this paper I have not sought perfection, but have hoped to aid in some way the solution of the problem, knowing well that in working out the details of any system for aid to the wounded, besides official concurrence, much must depend on the abilities of medical officers, who must adapt themselves to the circumstances existing at any particular conjuncture.

FIG. 1. Stretcher, closed.

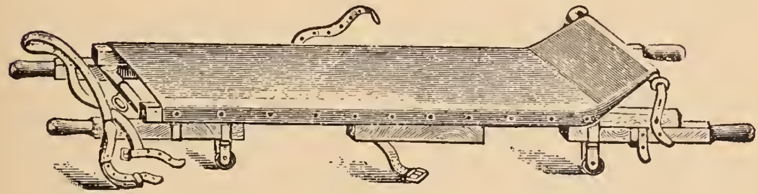


FIG. 2. Stretcher, open, showing Telescopic Handles.

FIG. 3. "Lowmoor Jacket," fixed on Stretcher.

IMPROVED "FURLEY" PATTERN STRETCHER.

These Stretchers, now in general use, possess, besides cheapness and portability, one great advantage in having no loose parts.

Fixed as in Fig. 3, patient can be sent below on stretcher-slide or hauled up vertically through hatches.

THE HANDLING OF THE WOUNDED ON SHIPBOARD DURING ACTION.

By E. R. STITT,
Past Assistant-Surgeon, U. S. Navy.

Ordinarily, in the peparation of an article treating of a subject belonging to the domain of medicine, the factor productive of greatest embarrassment is the vast amount of literature in relation thereunto which, primarily, it is necessary to consider. There exists, however, as a rule, a certain compensation, inasmuch as there is an accepted method of treatment and order of procedure. These are entirely lacking in dealing with the problem of the handling of the wounded on board ship when in action. One authority will view the subject from the standpoint of a battle-ship—another, from that of a cruiser. A French writer will arrange plans, for the proper working of which it is necessary that two ships approach in a straight line, meet, and continue on their respective courses. A Russian will take the opposite view—that the engagement will go on with the ships describing the perimeters of circles, as was the case in the "Alabama"-"Kearsarge" fight. The instances might be prolonged *ad infinitum* were it necessary to more strongly bring out the fact that the matter is one in which individual opinion must prevail until practical experience sets its approval on some one method.

In treating the subject I shall divide it into a number of considerations, more or less distinct, but all having an important bearing on the matter at issue, and when collectively viewed, giving ideas far more comprehensive than if dealt with as a whole. These considerations, which naturally take a certain order of precedence and importance, are as follows:

1. The number of medical officers necessary on board ship in time of action, and the detail and qualifications of their assistants. It will be readily conceded that on board ship when operations are

to be performed, at least two surgeons are required. This is apparent when rapidity of work, greater accuracy in judgment, perfection in technique, and, *a fortiore*, the greater chance of at least one escaping the fate of battle when there are two or more on board, are considered. Again, if there were a great number wounded, it would exceed the limit of endurance of one man to deal with all the cases. As an instance of what might happen, it may be recalled that there were one hundred men wounded on board Nelson's flag ship, the "Victory." In this day of shells and high explosives these figures would probably be greatly exceeded. Furthermore, it is an open question whether it is advisable to keep one surgeon on the spar-deck to take charge of his subordinates in their first aid and transportation duties, and to alleviate suffering by the judicious administration of hypodermic medication. If this important duty is to be performed, at least three medical officers are required.

The deficiencies in the complements of the ships of our Navy make requisite the services of the entire deck force for the handling of guns and the transportation of ammunition. As even the servants, a large number of whom are foreigners, are called upon in the performance of this most important duty, from what source can we secure stretcher-bearers and first-aid men? It is true that two men are detailed from each gun division to act in this humane capacity, but this is an entirely subsidiary consideration, and there is great doubt if their services could ever be secured, except possibly in freeing the gun tracks or turrets of obstructive wounded. From the above it will be seen that, in case we engage in war, it will be necessary to increase complements in order to adequately provide men to care for the wounded. In the English service, in addition to the permanent force of medical subordinates — the apothecary and two or more sick-bay nurses, whose services would naturally be required in the sick-quarters, and could not be considered in connection with the deck work — there are detailed the pay officers, and their clerks and assistants, the mess attendants, and the police of the ship — ship's corporals, etc. This gives the medical officer of a ship like the "Blake," thirty-one men for the performance of first aid and stretcher duties. This force is drilled once or twice weekly.

In the French service there are more bay-men than in the English. The extraneous force, however, is less, this being drawn

from the complement of carpenters and sail-makers. In France, a candidate for the position of sick-bay nurse, of which there are three grades, attained after the passing of examinations, is required to know how to read and write, and to have a certificate of good character, and is instructed for six months in a hospital on shore before going on board either a hospital or cruising ship. It would appear that a modification of this system would best adapt itself to the needs of our service, viz.: To provide instruction in one of our naval hospitals and on board receiving ships for a Hospital Corps. We should then have at least an efficient and trained nucleus in time of need.

In this connection a few historical facts may be of interest:

(*a*) The earliest record of medical military service is found in an inscription discovered at Deli, in Cyprus, the probable date of the same being 450 B. C. It is to the effect that a physician, Onasilas, went out with his pupils to attend those wounded in war, and received therefor great rewards.

(*b*) There exist epitaphs of three naval surgeons who served in the Roman triremes, "Cupid," "Tiger," and "Faith," and of peculiar interest is the attribute duplicarius, or double pay, associated with their names, indicating that even at that period special inducements were necessary to secure the services of this branch of the service.

(*c*) Xenophon, in treating of military affairs in Lacedæmon, tells us that the surgeons occupied the rear of the right wing of the army, and that in company with them were the flute-players, priests, and volunteers; and, although no mention is made thereof, it would appear probable that these acted in the capacity of surgical assistants.

2. The best place on board ship for the care of the wounded. At first thought there would appear but one solution of this problem, the answer being the most accessible space below the protective deck. In practice, however, so many factors interfere that the apparent advantage of increased protection is nullified. These factors are as follows:

(*a*) One of the precautions to be taken in action, most strongly insisted upon by the Royal Naval College at Greenwich, is that the protective deck must be absolutely sealed, except where armored

gratings and armored hoists are employed. If this be enforced, it is manifestly impossible to utilize any space below the protective deck.

(*b*) Especially in battle ships, as in the well-known English "Royal Sovereign" class, although true as well of cruiser types, the space below the protective deck that could be used for the care of the wounded is employed as a submerged torpedo room. Now, although an estimate of the floor space would indicate that from forty to fifty wounded could be accommodated, yet it would be impossible to work the torpedo tubes were there more than ten or fifteen men lying on the deck.

(*c*) Below the protective deck there is absolute dependence upon artificial light, and only electric light meets the requirements of operative work. There is always a strong probability of the light circuit being damaged, and it should be remembered that the fact of electric plants on board ship being generally in triplicate does not enter into consideration in this instance, as these spaces are wired with but single circuits.

(*d*) Parodoxically, there is little doubt but that the most dangerous place on board ship in action is in the most strongly protected part. There is no better exemplification of this statement than that afforded by the "Victoria" disaster. Of the fifteen line officers, below the rank of admiral and above that of midshipman, who were on deck, but one was lost; whereas, of the six engineer officers, who were below the protective deck, five were lost. The same fate would have happened to the medical officers had the ship been cleared for action. In this case the loss of the ship was due to ramming, but the result would be the same should the ship be torpedoed, or if a shell should penetrate below the protective deck, as in the recent battle at Wei-ai-Wei, when one of the ships, in turning, heeled markedly, and was struck below the protective deck by a large shell, that caused her to founder.

(*e*) Below the protective deck the spaces are, of necessity, extremely small and confined, by reason of water-tight compartments. Again, the plans of a ship are always so arranged that the protective-deck hatches do not come directly under those leading down from other decks, thus entailing great interference with the transportation of the wounded. On board the cruiser "Baltimore" it

was quite an effort for an uninjured person to descend to the cock-pit, and the lowering of a wounded man would have been next to impossible. In view of the obstacles attending the employment of spaces below the protective deck for the wounded, the question naturally presents itself: Where is there a space suitable for the purpose?

On battle ships an available and satisfactory situation generally exists immediately above the protective deck. This is protected on all sides by from five to seven inches of armor, and out-board by coal bunkers, likewise. As ammunition hoists are on either side, this space would be free from interference. The above is true of the English "Royal Sovereign" class.

When we come to consider armored cruisers, we find a space between the casemates on either side where could be placed from ten to twelve wounded. This would afford an armor protection of about ten inches from broad side fire, but of course there would exist practically no protection from fore and aft fire.

On the English cruiser "Blake" this method is in force, and as there are three pairs of casemates, from thirty to forty men could be accommodated. Apparently, on cruisers of the protected or partially protected class, the only available spaces would be those between the store-rooms, which are commonly located just above the protective deck, or the ward-room. Of course, at present the wood-work of a ward-room would, by reason of splintering, make it frightfully dangerous; still, if, as is now the tendency, this be obviated by the substitution of some non-splintering material for wood, no valid objection can be advanced.

In these parts of the ship it is the custom to store away the wood-work lowered from the upper decks. Of course, if such custom were to prevail in actual action, they would be converted into death traps.

In concluding this section, a consideration of the plans of a very modern vessel, the "Infanta Maria Teresia," of the Spanish Navy, will be instructive. The cock-pit is located just above the double bottom, under the protective deck, and just abaft the ram. To reach it, it is necessary to descend fifteen feet from a hatchway located in the extreme forward part of the spar-deck, then ten feet down another hatch down a ladder, and, finally, to lower the wounded

man seven feet into the hospital, as it is designated, a space only twenty feet in length. The greatest obstacle encountered is that the upper hatchway is directly in the line of fire of the eleven-inch gun, and only eight feet from the muzzle; consequently, it would be impossible to remain at the hatchway when the gun was in use.

3. With reference to the proportion of the crew of a ship killed and wounded, and the effect of a shell exploding in proximity to a gun's crew.

While the statistics which obtain in the naval engagements of the past quarter of the century do not in any degree represent what would happen at present, they are of interest and of value in giving an approach to these probable results. In the battle at Lissa, between the Italians and Austrians, the Italians had about 600 men out of 5,000 placed *hors de combat*, or, to express the fact differently, about twelve per cent. In the battle of Heligoland, between the Austrians and the Danes, the former lost in killed and wounded 144 out of 850, that is, seventeen per cent.; the proportion between killed and wounded being as one to three; but on one of the Austrian ships twenty-one per cent were either killed or wounded. In the engagement between the Peruvian turret ship "Huascar" and the Chilian battle-ships "Almirante Cochrane" and "Blanco Encolado," in which the "Huascar" was captured, there were thirty per cent of her crew killed or wounded. In the battle of Riachuelo, between Paraguay on one side and Brazil, Argentina, and Uruguay on the other, the former lost fifty per cent in killed and wounded.

As instances of what might be expected to result in case a shell exploded in proximity to a gun's crew, the following are of interest: At the battle of Lissa a 300-pounder Armstrong shell exploded near a gun's crew, killing twenty men and wounding many others. During the "Alabama"-"Kearsarge" fight off Cherbourg, France, a shell exploded on the "Kearsarge" in the midst of a gun's crew of nineteen men, fifteen of that number being killed or wounded. In the naval engagement at Punta Angamos, a shell struck the turret of the "Huascar," pierced it, and burst, killing ten of the twelve men on duty therein, wounding one, and the other escaping uninjured. At the fight incident to the passage of the Menan, a five-inch shell from a French vessel exploded on board a Siamese one, killing ten and wounding twelve men.

The foregoing indicate the terrible possibilities of naval warfare at a time when shells, ammunition, and guns were, as compared with those of the present date, in their infancy. Now, if, as is shown above, the percentage of killed and wounded then amounted to from fifteen to twenty per cent, at present the slaughter should be frightful, for the following reasons:

(*a*) The great development of rapid-fire guns, as a result of which, instead of but one to two shells being fired in a minute, there are now discharged in the same time from twelve to seventeen.

(*b*) The great improvement in the shells themselves, the modern fuses making their bursting practically certain; and, furthermore, the high explosives contained therein making their effect far more terrible.

(*c*) The most approved plan of procedure, when about to engage in battle, is to hoist up as much ammunition from the magazines as possible, and distribute the same about the different guns—if, as is the case in the French service, these shells are loaded with melinite, the result would be terrible should a shell explode in the midst of this array of shells.

The above expectations are more than verified in the meager details concerning the battle of Yalu, which have recently been received. For instance, the Chinese ship "Chen-Yeun" was hit nearly 100 times; every thing above water was riddled, and out of a crew of 460 men, 350 were either killed or wounded. Then, again, we learn that a shell from that ill-fated vessel struck the port quarter of the Japanese cruiser "Akag," killing and wounding thirteen men. It has been seen that at the battle of Heligoland one of the Austrian ships lost twenty-one per cent of her crew in killed and wounded, but here on board the "Chen-Yeun" we find this to have reached the enormous proportion of seventy-six per cent.

4. As to the first aid to be instituted before the wounded are removed to the sick-quarters.

In this connection we must consider the entire ship's company, not the medical force alone, and the first and most important question to present itself is, what shall be the character of the instructions given the men to prepare them for the performance of this duty. If the bounds of the most elementary and simple rules of first aid be exceeded there is little doubt but that the advantages to be attained

by such a course of lectures will be lessened if not altogether nullified.

The following plan was in force on the United States steamship "Chicago," and apparently gave satisfactory results. Each division was instructed separately in the characteristics of arterial and venous hemorrhage, and great stress was placed on the jerking and spurting nature of arterial bleeding, and the necessity of immediate assistance when this existed. Venous hemorrhage they could leave to the medical assistants. The lines of the femoral, brachial, and common carotid only were pointed out, and the best point to select in the line, with the direction of pressure indicated; they were immediately, in case of arterial hemorrhage, to make use of digital compression until a tourniquet or compress could be applied.

The experience of nations on the battle-field having demonstrated the inefficiency of the screw and field tourniquet, no instruction regarding these was given. The application of the Esmarch tube, and of the elastic suspender employed in the German Army was discussed, and also the Maw tourniquet and a modification thereof by Doctor Ormsby, of Dublin, were demonstrated. In both of these the principle is that of a pad attached to a piece of rubber tubing, which encircles the limb, and is secured in a groove or interspace on the upper surface of the block. The Bureau of Medicine and Surgery has recently adopted a rubber tubing for the control of hemorrhage, with a most simple and effective ball device for bringing the ends together, which possesses many advantages over those detailed above.

In addition, every man was instructed in the improvising of methods for the control of hemorrhage from means at hand — the neckerchief was to be taken from the wounded man and loosely tied around the wounded limb; a pad, made of an article of clothing, a section of rope, a rifle magazine, or a piece of leather belt rolled up and cut off, was to be placed at the point indicated in the line of the artery; a watch cap was to be inserted under the neckerchief, where torsion with a bayonet was to be made, to prevent the abrasion of the skin, and finally, the bayonet was to be tied in the long axis of the limb by the knife lanyard.

The great disadvantage attending the employment of tourniquets is the danger of gangrene, or at any rate, the production of conditions unfavorable to the success of subsequent operations. During

the recent civil war in Chili, numbers of cases were brought into the hospitals in which there existed local traumatic gangrene, due to the application of instrumental compression. With the rubber contrivances there is likewise to be considered the deterioration which articles of this material undergo at sea. The fact that but a short interval of time elapses in naval warfare until the wounded person is under the care of the surgeons, would indicate that the principal reliance should be placed in tampons and compresses rather than in central instrumental compression.

There should be at hand, ready to be served out in event of battle, a large number of antiseptic packages, with safety pins by which they could be attached to the inside of the shirt. These packets need only consist of several layers of dry sterilized gauze and a gauze bandage, loosely rolled for reasons of adaptation. When required for use the gauze should be employed as a tampon, and the bandage tightly wound around the limb, commencing below the wound, several turns being made over the tampon. The efficiency of this procedure was most strongly demonstrated in the case of a soldier who had been shot through the ankle joint at the battle of Placilla. So great had been the injury that there existed lesions of both anterior and posterior tibial arteries. An ordinary oakum compress had been applied to each orifice of the wound, and a rubber bandage wound around for compression. Upon examination after amputation a mass of coagulated blood was found in a perfect aneurismal sac, communicating with the two arteries.

There is a work by Bowles, entitled "Stertor and the Management of the Apoplectic Condition," in which the importance of the position in which an unconscious person is placed is set forth. From a perusal of the same, it would appear of advantage to adopt this postual method in time of action — that is, to place the person on one side, with the head in marked extension.

5. (The most important, from a practical standpoint, of our considerations.) The transportation of the wounded to the sick quarters. Historically, the first reference we find concerning this matter is in Xenophon's "Anabasis," where it is stated that the wounded were carried from the field on the backs of their comrades, and a case is mentioned in which one of the soldiers tried to bury his burden prior to the death of the latter, for which offense he was publicly scourged by order of Xenophon.

In connection with this may be presented a contrivance for carrying the wounded on the back, devised by Dr. Froelich, of the Medical Corps of the Swiss Army. There is a piece which is attached to the back of the one carrying, supplied with leather straps, and a seat which can be folded up, as is also the case with its supports or brackets. The weight is about seventeen pounds. This method, or some modification thereof, would be as efficient on board ship as that of supporting or carrying the wounded man along decks. The great objection would be the time consumed in securing and releasing the injured person, and by reason of the impossibility of descent to lower decks, the necessity for some other arrangement for lowering.

Of the numberless cots which have been proposed, the following are the most prominent:

a. The stretcher devised by Dr. R. A. Mowll, a description of which was published in the "London Lancet." It is a framework so arranged that it can be employed as an invalid chair, when it very closely resembles the ordinary steamer chair. By adjusting handles attached to either end of the apparatus, it can be converted into an admirable stretcher, and finally, by means of straps centering in a ring, it can be converted into a serviceable cot for lowering. The objections on board ship would be: (*a*) the complicated mechanism; (*b*) the requirement of considerable space in descent, and (*c*) most probably its cost.

b. The Gorgas cot. In this, the ordinary cot for swinging the sick in the sick-bay is employed; that is, the rectangular framework, about two and one-half by seven feet, covered with canvas and with canvas sides to a height of six to twelve inches. An inclined plane is placed at the lower end, and a strap is arranged at the upper, so as to go around the chest of the wounded person just below the armpits. This device requires a hatchway larger than those at present on board ships, and also necessitates considerable time in the securing and releasing of the injured man.

c. The Gihon cot. This consists of a wooden frame, across which is stretched strong canvas. Is has canvas bands to go around the chest, from the perineum and over the groins, over the ankle joints, and also across the shoulders. The advantage of this arrangement is that a person can be lowered vertically without the slightest danger

of his falling out. The great length of time necessary to strap the wounded man in and release him upon his arrival at the sick quarters, preclude its use in time of battle.

d. The Rapid Transit Ambulance Cot, designed by Medical-Director Henry M. Wells, U. S. Navy.—In all other cots longitudinal pliability is sacrificed to lateral stiffness. In this the latter advantage is obtained by means of hickory slats stitched in across the canvas. It also has sides and ends to retain the wounded person when the cot is lowered at an angle. There are ten canvas handles stitched in on each side, so that it is possible to distribute the points of support most advantageously according to the distribution of the body weight.

e. Dr. Pohl, of La Hague, has devised a cot, about seven and a half feet in length, which folds upon itself in the middle, so that it would occupy but little space on board ship. The great objection to its use is the length of its legs. Another European stretcher is that of the system J. Paynreville, which would take up but very little space. It consists of two wooden poles with concave cross-pieces, which are provided with hinges, so that they allow the folding up and approximation of the two poles. Canvas is attached to the poles by lacing, and can be removed when soiled.

f. On board the French battleship "Trehouart" there has been placed an elevator, which extends below the protective-deck from the spar-deck. It is supposed to offer great advantages by reason of the rapidity with which it descends and the number of wounded who can be lowered on it at the same time. In reply to interrogation concerning its efficiency, the French Ministry of Marine gave information that at present (March, 1895) it had proven unsuccessful, and that many modifications would be necessary to make it applicable to the purposes for which it was intended; at any rate, they are not disposed to make trial of a similar apparatus on any other ship.

g. Dr. J. D. McDonald, R. N., has designed an ambulancee lift in which the hammock is employed. The clews of this are attached at either end to a wooden pole four and a half feet in length. A span, with an eye in the middle, supports the apparatus. A support under the bend of the knees is also attached to the pole. This, of course, is a permanent cot, its only advantage being the ease with which it can be extemporized on board ship.

h. Finally, I shall present a method of transportation, with an apparatus for the carrying of the same into effect. In the first place, it is intended to utilize articles which are always at hand, and with this idea in view, one of the hammocks (which are distributed equally about the spar-deck in the nettings) is to be taken down, unlashed, the mattress remaining in the hammock, the injured person placed on the mattress, the blanket spread over him, and from three to four lashings taken around his body, the first lashing being secured under the armpits. With the object of moving the wounded person as gently and effectively as possible, the following drill has been employed: The hammock is placed in line with the body, two stretcher bearers take positions, 1 and 2, respectively. No. 1 with his feet at the sides of the man's chest, the toes as close to the armpits as possible, stoops and locks his hands under the shoulder blades; in case the arms of the wounded person are uninjured he clasps No. 1 around the neck, in this way greatly assisting. No. 2, with the right foot between the knees, and the left alongside the right hip of the man, bends his right knee and takes hold of the legs at the knees. At the signals *ready*, *lift*, from No. 1, they raise the body in unison and, keeping step, by No. 1 counting one, two, one, two, etc., they move forward and deposit the wounded person on the hammock. After the lashing is completed the man is temporarily put to one side until some person or persons, detailed for the purpose, come up and transport him by dragging the hammock along the deck, which can be done most rapidly and easily with one at either end, to the hatchway, where one of the stretcher bars (to be described further on) is rigged. In case the services of the two divisional aids to wounded are not immediately required at the gun, by reason of a temporary lull in the action, they could effect the transportation.

If the ship have a gun or berth-deck, hammocks should be distributed in those decks from the spar-deck. The stretcher bar consists of a piece of one-inch wrought-iron piping, seven feet in length, with the ends forged flat and holes drilled in them. Snap-hooks, such as are employed in harness, are attached to these ends; a binding strap, moving freely on the pipe, gives the point of support, and is capable of being tightened by a thumb screw. The object of this is to enable one to lower a wounded person at any degree of obliquity. When the men transporting the hammock reach the

hatchway where one of these stretcher bars is rigged, they snap the hooks into the hammock rings and lower away. Upon reaching the sick quarters the same are disengaged, and the injured person is placed to one side in his hammock. The bar is immediately hoisted up. The advantages of this method presenting themselves are:

a. The moral effect of having contributed to the comfort and care of a comrade, instead of allowing him to remain lying where he was wounded.

b. The ease and freedom from pain, and improbability of injury which this method of transportation along decks offers over that of supporting or carrying the man.

c. The great rapidity with which the hooks of the bar can be snapped into the rings of the hammock, the man lowered, and the hooks disengaged upon reaching the sick quarters.

d. The fact that a man can be lowered down any hatchway, which will allow the shipping of a ladder.

e. The ease with which it can be guided in descent, and the impossibility of dropping the injured person out.

f. When the wounded man reaches the sick quarters he has his hammock provided, and not placed on the bare deck.

g. The simplicity and small cost of the bar, which, moreover, can be made in a few hours on board any ship.

h. Only two men are required to manipulate and lower it.

7. Final considerations regarding the wounded.

Undoubtedly, in case of an engagement between two fleets, the most important surgical work would be done on board the hospital ships, which would accompany their respective forces, remaining beyond the range of fire until the action had terminated, and then coming up and receiving on board the wounded from the men-of-war, irrespective of sides. The ships which would probably be selected for this purpose would be fast, large ocean liners, which could, with slight alterations, and in a very short time, be converted into floating hospitals, carrying a large medical force, surgeons, and nurses. They would be under the protection of the Red-Cross flag, and after an engagement it is generally conceded that the hospital ships of the unfortunate fleet will be allowed to take their wounded, after they have been paroled, to the nearest home port—there to receive better attention than would be possible on the most perfectly equipped hospital ship.

THE RELATION OF RED CROSS ASSOCIATIONS TO THE MEDICAL DEPARTMENT OF THE NATIONAL GUARD.

By CHARLES R. GREENLEAF, Lieutenant-Colonel and Deputy Surgeon-General, U. S. Army.

The Treaty of Geneva, under the Articles of which the medical service and the sick and wounded in the armies and navies of civilized countries are in time of war "neutralized," was the outcome of an international conference of philanthropists assembled at Geneva, Switzerland, in 1863, which, with the full concurrence of its medico-military delegates, declared as the basis of its deliberations that "at all times, and among all nations, from Cyrus to Napoleon III., the personnel and material of the Army Medical Departments, or the corps analogous to these, charged with the care and transport of the sick and wounded, have been insufficient" to fully accomplish that object.

It concluded its work by passing a series of resolutions, the first four of which are of great significance and interest to this Association, and are as follows:

The International Conference, being desirous to give aid to wounded soldiers iu all cases where the military medical service shall be inadequate, has adopted the following resolutious:

ARTICLE 1. There shall be in every country a Committee, whose duty it will be to co-operate, in time of war, by all the means in its power, with the sanitary service of the army. This Committee shall organize itself in such manner as may appear the most useful and expedient.

ART. 2. Sections, unlimited in uumber, shall be formed to second the Committee, to which the geueral directiou will belong.

ART. 3. Every Committee shall place itself in communication with the Government of its own country, in order that its offers of assistance may be accepted in case of need.

ART. 4. Iu time of peace the Committees and Sections shall be occupied with the means to make themselves really useful in time of war, especially in preparing material aid of every kind, and in endeavoring to train and instruct volunteer uurses.

After the adoption of the treaty there were formed, in the countries that became parties to it, Civilian Relief Associations, whose objects were based upon the resolutions of this Conference, and whose general interests were, by tacit consent, watched over by the International Committee at Geneva, a relic of the original Conference of 1863, which, to use the words of its President, M. Moynier, "assumed the responsibility of acting, to some extent, as a self-constituted referee;" although upon this important point the following extract, from an address on the "Red Cross and First-Aid Societies," delivered by Mr. John Furley, at Chicago, in 1894, before the International Congress of Charities, is of interest:

It is generally but erroneously supposed that the *Convention* of Geneva had in view the formation of a Red Cross organization, and that the numerous societies which have since been established under its flag are regulated *by some occult international tribunal.* Undoubtedly the International Committee, composed of five or six Swiss gentlemen, sitting at Geneva, has contributed largely to the solidarity of the Red Cross movement, but it can uot be too widely known that each Red Cross society has a separate and national existence, although its *objects* are international; each has its own constitution and rules, and these are quite independent of foreign control.

In 1881 Miss Clara Barton, to whom this country owes much of its knowledge concerning the Treaty of Geneva and Red Cross associations, obtained from the authorities of the District of Columbia articles of incorporation for the American National Red Cross Association, of which she became the President, and carried on the great charitable works of relief in times of national disaster, such as the Johnstown flood, the South Carolina earthquakes, etc., that have made her name an honored one in every household in this land. These works, great and noble as they are, have, however, developed as a logical sequence an optimism regarding the necessities for *a time of war* that has been fatal to the primary object of such associations, as set forth in Article 4 of the Resolutions.

When, as medico-military men, we take account of our *armamentarium* for war service, we find our department in almost every State actively engaged in bringing its personnel and material to the highest

point of efficiency; old statutes are being changed to meet new conditions, Hospital Corps are being organized, officers and men are being drilled, papers are prepared and read on the improvement and construction of material, and a general zeal and interest pervades the establishment; but, notwithstanding all this, we fully appreciate the inadequacy of our means to accomplish the work required in the hour of need, without the assistance of that indispensable colleague, the Association of the Red Cross, and we very naturally turn to inquire what is its state of preparation for this service?

This "link between the civil and military element" which M. Moynier regarded as a "necessity," is not to be found. There is no intercourse between that Association and the Medical Department of the National Guard, or its members, who are especially trained in its peculiar work; there are no organized sections in any of the States—no effort is made for improvement in field supplies, transportation, or hospital organization—in fact, we can not but be surprised at the entire absence of attempt to organize the volunteer aid in this country, which we all know is more than abundant and ever ready to place itself at the side of its trained colleague in time of war. Looking abroad, we see that Germany has for years had a network of working sections throughout the empire that are in close touch with her civil population, and enabled her on the outbreak of her war with France to make use of over 2,000 of them so soon as the first movement of troops was made. For ten years Japan has had a similar organization, that placed itself at once under the Medical Department when war came with China. In Sweden, France, and Italy experiments with and trials of new systems of shelter and transportation have been made by Red Cross societies during the annual army maneuvers, in conjunction with the reserves; in Holland, Russia, Austria, in fact, throughout Europe, like organizations of volunteer aid have existed for years, each and every society being in close touch with the civic-military force of the country.

M. Moynier, President of the International Committee of the Red Cross, says:

The Conference of 1863 desired that the formation of aid societies should not be left until black clouds appeared on the political horizon. After the terrible experiences of 1870 we saw the societies of the belligerents, as

well as several neutrals, actively occupied in preparations, which they repented having too long neglected. This wise forethought is imposed on all the societies of the Red Cross, and it is one of the traits which distinguish it the most advantageously from similar institutions of former time.

The utility of these precautions has not yet been appreciated at its proper value; and, alas! there is more than one society that remains inactive, either because it belongs to a people little inclined to be warlike, or that it imagines that there will always be time enough to arouse from lethargy when the danger is near. In order to be able to collect, carry away, and tend the wounded, many conditions are indispensable. First, it is necessary to have at disposal a numerous personnel, as the murderous weapons employed in the present day make so many victims that the assistance of a few volunteers would be insufficient. Then, the delegates of the Red Cross must have been trained to their duties, for otherwise they would do more harm than good. Can any one estimate the loss of time and money that a society would sustain if it were obliged to procure hospital and transport material in a hurry, and had not previously bestowed any attention on this subject? The ability to make a judicious selection of medicines, appliances, stretchers, carriages, tents, and barracks amounts to a science. Even if the assistance of specialists was invoked, it would still be difficult to avoid delays and mistakes. (The "Red Cross," Ed. 1883, pp. 55-58.)

It has been authoritatively stated, and, indeed, is set forth, in the preamble to a Bill to protect the insignia of the Red Cross, which was before the last and previous Congresses, "that it becomes necessary that there be in every nation within the treaty one body or oganization" to regulate, etc., the Red Cross. This is an error arising from a construction given by the International Committee to the first article of the Conference Resolutions. As a matter of fact, there are two or more such organizations existing under governmental sanction in several foreign countries, notably Great Britain, Austria, and Hungary.

In view of these facts, is it not our duty to take measures for the organization of an association which shall be in direct affiliation with our volunteer military establishment, and under its direction, receive that training which we all know to be essential to efficient service in field work?

There seems to be no good reason why this should not be done; the work of the American National Red Cross Association need not be interfered with; on the contrary, the two associations could work in harmony, each doing its special line of good work, the American Association continuing to devote its attentions wholly to relief

measures in the disasters incident to peace, while our Association would, by practical work, prepare itself for war.

The Medical Department of our National Guard is made up of active and zealous civilians — busy practitioners — men of influence in every city and State of the Union, whose families and friends are thoroughly interested in this work. In these, we have ready at hand the personnel for a National Red Cross Association that can fulfill the conditions set forth in the Resolutions of the Geneva Conference, indispensable to successful service in time of war, and that would be in sympathy with the official sanitary organization, upon whose shoulders the burden and heat of the day must fall at such a time. What more fitting material than this is possible for the formation of such an auxiliary? I suggest that we take this matter in hand at once; organize a National Society, with articles of incorporation from Congress; this National Society to organize sub-societies in every State in the Union that has a National Guard Association; these sub-societies to be instructed by the Medical Officer of their district in the methods of military administration, and required to furnish a detail of graduated pupils to attend every encampment for the purpose of instruction in the duties that may devolve upon them in time of war. The average civilian needs this vastly more than we need it.

With such an organized auxiliary our Army and Navy would be able at any and all times to cope with the results of any war in which our country may be engaged, let the character of weapons, numbers engaged, and the number of wounded be ever so large.

Without it, we will continue to be, as we are now, unprepared in time of place to meet the exigencies of a time of war.

THE POST EXCHANGE, FROM A MEDICAL STANDPOINT.

BY MAJOR PHILIP F. HARVEY, Surgeon, U. S. Army.

The preparation of this paper was undertaken at the invitation of the Literary Committee of this Association, received in December last. It is no affectation when I say that I can but wish that the report had been entrusted to abler hands. But, fully appreciating the compliment implied by the invitation, I have taken pleasure in investigating the subject, and in trying to present it fully and frankly, and to the best of my ability.

My aim has been to take a practical view of the question, although a great deal might be said about it on its sociological side, as it furnishes an instance of one of those reforms whose influences may ramify in directions other than the ones in which they were specially intended to operate by their originators; but it is obvious that a discussion of any other than the local influences of, and the practical work accomplished by, the Post Exchange would be out of place on this occasion. Its effects upon discipline and military efficiency have been pretty thoroughly studied and discussed, but its bearings upon the health of troops has received much less attention, and I know of no published data that deal even indirectly with this side of the question. Its newness, therefore, gives it an interest and importance that it would not otherwise possess, but at the same time adds to the difficulty of its full and impartial presentation.

The scope of the special inquiry before me appeared to be embraced by a study of the following points:

1. Has the substitution of the Post Exchange for the post trader's store been beneficial to the health and morals of troops?

2. If beneficial, the nature and extent of the benefit realized; as, for instance, decrease of drunkenness and diminished number of

cases requiring medical treatment after pay-day, as compared with the same before the introduction of the Canteen system.

3. Have any evil effects upon the health of troops resulted from over-indulgence in eating or drinking at the Post Exchange? If so, to what degree, and in what way?

4. Is it advantageous to the health of the men to have the ration supplemented by a cheap lunch at the Post Exchange?

5. Has Government provided suitable buildings at garrison posts for use of post exchanges?

6. The resources and conveniences of post exchanges for furnishing staple commodities, lunches, beverages, etc., facilities for writing, reading, and gymnastic exercises.

7. Suggestions, from a hygienic point of view, as to improvements upon the present Canteen system.

My own opportunities for obtaining the knowledge essential to the full consideration of these questions having been somewhat meager, it was necessary to obtain some collective information. Accordingly, a circular letter was prepared, embracing substantially the above points, and a copy sent to each of a number of medical officers for their views and experience thereon. All favored me with replies of interest and value, evincing close study from an impartial standpoint. An analysis of them will be made under the several headings in the course of this paper. The posts from which I sought the experience of medical officers were selected as being representative.

HISTORY.

The establishment of the Canteen in our service is of such recent date that its history must be more or less familiar to many here. A review from its inception to its present state of development, sufficient to our purpose, can be sketched in a few words.

We are indebted to the English service for the idea of our present system. Fifteen years ago General Morrow and some of his captains, at Vancouver Barracks, Washington, introduced the first canteen in our Army. It was operated successfully for some years without sale of any alcoholic beverage, and when the 14th Infantry replaced the 21st at Vancouver, the Canteen was continued, with slight interruption, at that post. It was regarded as an excellent

model for other similar institutions. A growing sentiment throughout the Army, especially at Army Headquarters, shortly after this time, began to take place, to the effect that a co-operative store for the benefit of the enlisted men, under military supervision, might be made to result in many advantages to them, such as affording them a place of resort during leisure hours, where they could obtain innocent amusement and avoid temptations to indulge in excesses. Department and post commanders made reports upon the subject, and the War Department finally concluded that the introduction of the system was a reform measure that was demanded for the best interest of the service, and by General Orders No. 10, Headquarters of the Army, February 1, 1889, rules and regulations for the establishment and government of post canteens were published to the Army.

It was early apparent that the interests of the canteen and post-trader were irreconcilable, and that the latter could not successfully compete with the former. It was also believed that there were certain defects inherent in the traders' system, which operated injuriously upon the discipline and morals of isolated garrisons. Paragraph 351, Army Regulations, forbids the sale of intoxicating liquors at military posts, but it was ruled that light wines and beer were not intoxicating in the sense of the paragraph, and this loop-hole permitted traders to reap large profits from this source. But by General Orders No. 75, Adjutant General's Office, September 27, 1889, the authority granted post traders to sell light beer and wine, was restricted exclusively to sales in *unbroken packages* to *officers* and *canteens*, such sales to be in competition with other dealers in like articles. It was made the duty of inspecting officers and department commanders to report any violation of this order, and the remedies applied or required to stop it. By the same order, paragraph 350, Army Regulations, was modified so as to deprive post traders of the exclusive right they had theretofore enjoyed — to trade upon the reservation to which they were appointed, by allowing canteens to make sales, at cost, of all commodities required by officers and soldiers. This necessarily took from post traders the profitable sale of staple articles; but what to them was the most damaging stroke, their death blow, indeed, was the fact that it stopped their retail traffic in alcoholic liquors. The orders and rulings in connection with the

subject of canteens are quite numerous, and cover, in their scope, all points of administration. They set forth fully the *purpose* of canteens, which, in brief, is to supply the troops with goods at a low rate of profit, and to afford rational recreation and amusement to all enlisted men; the sale of ardent spirits is strictly prohibited, but commanding officers are authorized to permit light beer to be sold by the drink on week days in a room set apart for this purpose when, in their opinion, such action is promotive of temperance. Gambling in any form is forbidden. Each canteen is managed by an officer selected by the post commander with regard to his fitness. This officer is allowed one or more enlisted assistants, as may be expedient or necessary; citizens and retired soldiers are also allowed as attendants at post exchanges. A standing committee of commissioned officers superintend all the affairs of the Exchange, rendering a report once monthly. A committee of non-commissioned officers, representing each company, is convoked quarterly and submits its views orally or in writing, in respect to the management of the Exchange, for the consideration of the Exchange Council. Duties, responsibilities, extra compensation to enlisted attendants, purchase and arrangement of stock and equipment, division of profits, each feature of the establishment, down to the minutest detail, is fully elucidated. It is unnecessary to enter more fully into these particulars, but suffice it to say, that despite the most determined resistance and the most plausible arguments from those interested in the post traderships, the Post Exchange is now an established institution in our Army, and a sufficient time has elapsed to enable us to form an estimate of the benefits or harm it has hitherto accomplished or may hereafter realize. On February 1, 1890, fifty-seven canteens were in successful operation. These had been established at different periods from July 1, to December 30, 1889. The sum of $150,000 was spent by the soldiers of the Army at those canteens during the last quarter of this period, of which amount $25,000 was returned in the form of dividends for the improvement of their tablefare, for their social enjoyment, and improvement. This, notwithstanding the fact that the quarter was one in which most of the canteens were obliged to pay for their stocks and fixtures out of this profit. (Report on Post Canteens by the Adjutant General to Chairman Committee on Military Affairs, February 21, 1890, page 35.)

By General Orders No. 11, Adjutant General's Office, February 8, 1892, the designation POST EXCHANGE was adopted in place of Post Canteen.

At the present writing there are seventy-five garrison posts in the Army at which post exchanges are in successful operation, at three of which (Forts Apache, Duchesne, and Washakie) there were traders December 31, 1894. The total receipts at all exchanges for the year 1894 were $1,417,079.62, and the dividend profits returned were $304,646.91. At twelve posts, taken at random, the receipts ranged from $17,000 to $79,000, the profits at each amounting to about $10,000. (See appendix A.)

To properly estimate the good or evil accomplished by the change of an established system or custom, it is necessary to have a correct knowledge of the effects of the practice in vogue prior to the innovation. The ideal is the aim of all reforms, but the attainment of the ideal is, perhaps, impossible of accomplishment so long as human nature is imperfect, and so long as different views are held as to just what constitutes human perfection. Any change in a man's environment that effects an improvement of his habits and tastes, or provides the means of ameliorating his condition, by giving him a better outlook, better food, greater opportunity for mental growth, and more rational ideas of his duties to himself and to others, is an improvement, and produces good that spreads beyond the narrow sphere in which it may have had its beginning.

Of all the vicious propensities with which man has been endowed there is none which has led to greater misery than drunkenness. Within the memory of men still living, certainly in times past not far removed from us, tippling or drunkenness was the rule, and temperance the exception. The wealthy, the educated, and even royalty itself, yielded to the blandishments of the Circean cup. In fact, all classes drank to excess, and the more a man could imbibe without being overwhelmed the more he was regarded as a man of merit. Soldiers have been deservedly charged with evincing this infirmity as markedly as any other class, but as it has decreased in civil communities, so it has lessened, but not to the same degree, among the men of the Army. Writing from Fort Custer, a correspondent of the New York Tribune, in January of this year (1895), says:

Whisky is the soldier's weakness. Should a post be 1,000 miles away from civilization, and stringent orders be in force forbidding liquor on the reservation, with every possible means taken to prevent its introduction and use, still the average soldier will, in some way or other, have his toddy in spite of every obstacle. He is bound to get it in some way. The greatest trial of the officer of the day is to keep whisky away from the prisoners and out of the guard-house, but it is impossible of accomplishment, for they certainly get it in some way whenever they want it. Whisky has been discovered being smuggled inside loaves of bread when food was brought to the prisoners. A sentry might fill the barrel of his musket with liquor, and walk his post smelling awfully like rum, but never be found out. Prisoners returning from work carrying stable brooms over their shoulders have had a flask or two concealed in the bulky part of the broom, and yet escaped discovery.

I do not know how true this picture is of the subject that it portrays at Fort Custer, but I do know that it is very much overdrawn as applied to the stations at which I have served during the past few years. In the palmy days of the post trader, when the sale of liquor was not prohibited, and, indeed, after orders forbidding it had been issued and prior to the establishment of post exchanges, the amount of drunkenness among enlisted men was a prolific source of disorder, affecting both the health of individuals and the discipline of companies.

The profits of post traders were enormous, and resulted mainly from the sale of intoxicants. Large sums were paid for appointments. It was common for a post of six to eight companies to yield a net profit of $40,000 per annum, which was practically lost to the men who paid it in, itself an evil only less in degree than the pernicious effects of the traffic. In short, the trader-store was a saloon which placed a premium upon intemperance. This, then, having been the state of affairs before the establishment of the Canteen, the postulate might be assumed, without argument or evidence, that any change would be an improvement. But we will hear the testimony, and then judge how far the substitution has been beneficial to the health and morals of the Army. I quote from answers received to my circular letter.

Major Turrill narrates an extensive experience he has had in witnessing the beneficial action of the Canteen in diminishing the number of cases from use of intoxicants requiring treatment, at Ft. Spokane, Washington; Madison Barracks, New York, and Ft. Riley, Kansas. At Ft. Spokane there were three places where liquors of a very

vile character were sold, just off the reservation. It was also sold surreptitiously at the post-trader's store. With the establishment of the Canteen the trader's store entirely stopped the sale of liquor, and two of the three outside places closed up. The amount of sickness from the use of intoxicating liquor diminished fifty per cent in the first six months. At Madison Barracks a number of places sold liquor without restriction within a short distance of the post, and the Canteen received but little patronage in consequence, and, therefore, no appreciable effect on the amount of drinking and sickness therefrom was noted. At Ft. Riley, where places for sale of intoxicants are four miles distant, the Post Exchange has been much used, and very little loss of time from sickness is the result, and such as does occur is traceable to the rum shops of Junction City, a neighboring town.

Major Cleary (Ft. Brown, Texas) believes the Post Exchange to be a decided improvement on the post traders in every way they can be compared. Under the old system the hospital was filled soon after pay-day with cases of alcoholism, with a few cases of delirium tremens, and wounds and injuries mixed in. Now, he says, he sees occasionally a mild case of inebriation, rarely an injury, and delirium tremens has entirely disappeared.

Capt. Phillips (Ft. Walla Walla, Washington) favors the Post Exchange on account of its being under the control of a commissioned officer of the Army, and thus is an aid to discipline and to the health and morals of the soldiers. He has noticed that the number of men who drink to excess in the Army has greatly decreased in the past four or five years. He attributes this, in great part, to the fact that a bad man is more easily got rid of, and that more care is observed in recruiting.

Major Lippincott (Ft. Adams, Rhode Island) is certain that there is vastly less intemperance in the Army than we had twenty-five years ago.

Capt. Birmingham (Ft. Trumbull, Connecticut) says the Exchange is beneficent to the extent that a good quality of beer has taken the place of a generally atrocious quality of whisky. This is somewhat offset by opportunities to get whisky outside.

Major Byrne (Ft. Assiniboine, Montana) writes me at length an interesting and careful statement of his views. He believes the

Post Exchange to be in the interest of health and morality. After stating the amount of alcoholism, and injuries resulting therefrom, recorded at his post during the course of several years, he expresses the opinion that the liquor, responsible therefor, was smuggled into the post or obtained from places where intoxicants are sold immediately beyond the reservation line. The Post Exchange he believes to have accomplished its good work mainly through giving greater comforts, better and more varied food, and the means of healthful and enjoyable exercise. The post trader gave none of these, but simply absorbed the soldiers' pay.

Major DeWitt believes that at Ft. Sam Houston, Texas, and at Ft. Leavenworth, Kansas, which are each adjacent to a city, that the large majority of cases of acute alcoholism treated in hospital result from outside drinking. Cases are more evenly scattered over a given period and not aggregated, as they were after pay-day, prior to the establishment of the Canteen.

Major Heizman (Ft. Douglas, Utah) believes the Post Exchange to have been beneficial to the health and morals of troops, in which opinion he is in accord with all older officers commanding companies. The Exchange at Ft. Douglas was established October, 1889. During the calendar years 1888 and 1889, total number of cases attributed to alcohol annually eighty-five per 1,000 of mean strength; during 1892 and 1894, admitted for same cause annually, 52.95 per 1,000 of mean strength. He has observed a steady decrease of drunkenness, and does not now notice any increase of sickness after pay-day.

Major Adair (Washington Barracks, District of Columbia) observes that among the advantages of the Exchange is that it provides a place for idle hours, which is under thorough military control.

Major Waters (Columbus Barracks, Ohio) states categorically the numerous ways in which the welfare of troops is enhanced by the Post Exchange, in the decrease of drunkenness, in the greater contentment of the soldier, in the agreeable and innocent diversions afforded, in the decrease of sickness, and in the reduction of confinements and trials by summary courts. And he has seen all these effects at posts where canteens have been established under very dissimilar surroundings. He expresses a doubt as to whether the Post Exchange has been as beneficial at recruiting rendevous as at western posts.

Major Girard (Ft. Sheridan, Illinois) believes the Exchange to have been beneficial to the health and morals of troops. At Ft. Keogh, Montana, in 1880, he was instrumental in establishing a "Coffee-Canteen," and the bar receipts of the trader fell off $1,300 per month.

It thus appearing from a multitude of witnesses that the new system is an improvement on the old, let us inquire if any evil effects requiring correction have grown out of it.

There is frequently an unreasoning adhesion to the old in usage, and opposition to that which is new, from a natural attachment which has been formed for the accustomed thing. This tendency is noticable in all human affairs, and opposition to the Post Exchange had its birth in this trait quite as much as in the self-interest of others who opposed it. A great many objections were formerly urged against the Canteen which time has shown to have been purely imaginary, or at least of no weight. For instance, it was contended that the relations between officers and men were such as to render the successful workings of a Canteen impossible. That it would be impossible to find among Army officers any who were sufficiently painstaking, enthusiastic, and of the business capacity to insure prosperity; that it would be unwise and subversive of good morals to maintain, under the commanding officer, a place where beer and wine were sold; that large credit purchases would be required to start canteens, and at many posts suitable rooms for their operation were lacking; that irregularities in business methods would be encouraged among officers in charge of canteens, and that soldiers detailed as clerks would cease to be instructed in their military duties, and their services would be lost to the Government. It is unnecessary to examine these objections in detail in order to show their falsity. The introduction and practical operations of the Canteen have disproved the validity of each and every one of them. Not one has stood the test of time and trial.

The advantage of the Canteen, from a commercial as well as from an abstract military standpoint, have been almost wholly unmixed with evil. Captains invariably speak of it as having worked great benefits to their companies. But some objections to the Canteen are urged by temperance advocates on the score of health and morals, on account of the sale of beer being permitted; that such

permission exerts a vicious tendency, encouraging men to indulge in beer drinking, and thus drinking habits are formed among those who might otherwise remain sober men. As this is the only feature of the Canteen system to which any serious objection has been made, to my knowledge, it will be well to examine it a little.

Reasonable people understand perfectly well that removal by law of temptations to drink do not change the appetites of men, and that stringent liquor laws have invariably aroused defiance and ended in failure to accomplish any practical reformation. We have seen that drunkenness, formerly very prevalent, has markedly decreased in the Army since the establishment of the Canteen. I am informed that with a fuller comprehension of the co-operative feature of the Exchange the men are giving it increased patronage, and are thus increasingly induced to shun outside saloons, where temptations to drink strong liquors would undoubtedly lead to much drunkenness and disorder. There has been observed also among the men a disposition to refrain from squandering their month's pay in two or three days on a debauch, but to use a little of it now and then through the month, and so preserve their wits and their health.

It would be a consummation devoutly to be wished if the use of alcohol in any form could be entirely suppressed, or at least limited to a use which should be advantageous to the human family. The only question is, how is this best to be accomplished? Is it not evident from the change for the better, which has, according to all testimony, resulted from the workings of the Post Exchange, that we have found the best means of accomplishing this in the Army? As Herbert Spencer has shown, human nature, although indefinitely modifiable, can be modified but very slowly, and all laws and institutions and appliances which count on getting from it, within a short time, much better results than present ones, will inevitably fail.* In the words of the venerable proverb, "Though you drive out nature with a club, yet will she always return."

The facts of history stand out with noon-day clearness in proof of this principle. It is folly to shut our eyes to the existence of a truth. There is an innate craving for a stimulant among all the nations of the earth. We deplore it and bend our energies to overcome it. We would, if we could, banish it with the wave of a magician's

* The Study of Sociology, page 120.

wand, but any Nineteenth Century child knows the impotence of such an expedient. If we can succeed in substituting a comparatively harmless beverage for one that inflames the passions, poisons the blood, and creates criminals and imbeciles, have we not practically solved the problem?

It is a matter of common observation that the effects of beer upon the organism are very different from those of distilled liquors, both as they affect the intellectual faculties and the cellular elements. An interesting clinical study, illustrating this, is given in a paper entitled, "Fifteen Years' Observations Among Beer-Drinkers," by Dr. Lambert Ott, in the "Medical News," of January 6, 1894. He says:

> The German brewer is by nature an honest, industrious, and good-natured individual, fond of his home and family, and in every way a congenial person; even the Irish and American brewer partake of these kind and congenial elements so common to the German brewer, leading one to believe that the constant association and use of beer as a beverage begets a distinctive type of humanity, possessing natures kind and pleasing. The physical peculiarities are a florid complexion, due, in many cases, to capillary varicosity, and a tendency to the accumulation of fat. Often I have observed young men of slight build, with no inherited predisposition to obesity, after a year or two in a brewery, acquire a sunny disposition and accumulation of fat, the attenuated and introspective dyspeptic being transformed into a happy and fat brewer. * * * An inveterate beer-drinker suddenly ceasing his drinking suffers no special inconvenience beyond the natural longing, which is of short duration, besides a rapid loss of flesh—I should say redundant flesh—a decline in his florid color, which is soon replaced by a paler hue, but at no time approaching the pallor of anemia.

Dr. Ott admits that the consumption of enormous quantities of beer may cause drowsiness and indifference to surroundings, but sudden abstention does not prevent a return to the norm, this fact standing in marked contrast to what occurs to whisky-drinkers. He differs with Osler, who is of opinion that beer retards digestion, but Ott has never yet seen or heard of complaints of indigestion among beer-drinkers, but states that with the use of other alcoholic potations during meals it is different. He has examined the vomit of the whisky-drinker after it had been in the stomach five or six hours, and could find no evidence of chymification whatever of the ingested food. He has observed some cases of subacute gastritis, chiefly during the Summer months, caused by pouring cold beer into

an empty stomach, but that those who thus suffered for the most part took their morning "schnapps," with half a dozen drinks interspersed between their drinks of beer. Rest, and simple, soothing treatment brought about convalescence in a few days.

Diseases of the lungs and heart he found uninfluenced by excessive libations of beer. The kidneys were rendered active, but cirrhotic liver and hobnail liver, so common in the whisky-drinker, *are not found in the beer-drinker.* Cases of delirium tremens were usually heavy beer-drinkers, with occasionally schnapps, who, by and by, found too little stimulation in beer, cast it aside, and drank stronger alcoholic liquor, until the direst result followed. He has observed a few laborers in a brewery who, for fifteen years on an average, drank twenty-five to fifty glasses of beer daily, in the aggregate from one to two gallons for each sixteen to eighteen hours, and at no time have they been ill or suffered any evil consequences of excessive libations. They are yet strong and capable of great labor.

It is only necessary to contrast with this picture of virtually unlimited beer drinking without appreciable detriment to health, the moderate use of light beer, as we observe it at our post exchanges, in order to realize that we are not in the presence of a very formidable danger in permitting the sale of beer. Indeed, I think the danger would lie in forbidding its sale. It is a species of safety-valve, a mild remedy for a serious malady, a harmless sop to Cerberus, the insensible influence to guide weak men into less dangerous paths. Take it away, and you would increase drunkenness, desertion, deviltry, and demoralization. It even appears to be unfortunate that Congress has forbidden the sale of beer at exchanges in prohibition States, as the effect of such restriction is to increase the use of whisky among soldiers who crave stimulants. The sale of beer should be regulated, and it is. Lieut. McAndrew, the Canteen officer at Plattsburgh Barracks, tells me that he saw only one man under the influence of liquor at that large post of 500 men in six months, and that was from whisky obtained outside. A system of issuing checks for one-fifth of the approaching month's pay has been introduced, and works well, as it tides over a portion of the month, and allows a would-be excessive drinker less opportunity to indulge his appetite than if he received his entire pay at once.

It may be argued that beer drinking encourages whisky drinking; that temptation is placed in the way of young men who have never drank. Possibly, and conceding for argument's sake the truth of all such objections against the sale of light beer at post exchanges, after deducting the disadvantage we will find that there still remains a substantial gain, that we have secured the greatest good to the greatest number.

In answer to my question, if any evil effects have been observed from over-indulgence in eating or drinking at the Post Exchange, my correspondents are practically unanimous in reporting that none, or very few, have been noticed. As a very large proportion of the ills to which human flesh is heir is connected more or less intimately with the digestive organs the importance of this inquiry is evident.

Major Turrill remarks that the records do not show a single case directly chargeable to the Post Exchange.

Major Cleary has not seen a case of illness from over-indulgence in eating, but has observed instances of excessive beer drinking, but the proportion of such was trifling as compared with what it was during the regime of the post trader; about as one to ten, he thinks.

Captain Birmingham believes that men of gluttonous habits may suffer from over-indulgence in both eating and drinking at the Post Exchange, or as a result of the improvement of their mess-tables, and states that he has occasionally observed such effects.

Major Byrne has personal knowledge of the evil effects of beer drinking in one instance, but not from over-eating.

Major Heizman traces all cases of excessive drinking to the adjoining city, where the poorest whisky is sold to soldiers at very low prices.

Major Adair believes that intemperance in alcoholics has been diminished by the provision of lunches to gratify the gastric cravings of idle men, and that there has been no increase of dyspeptic or other diseases.

Capt. Powell has not observed any ill effects on the health of the men from over-eating or drinking at the Post Exchange.

Major Waters thinks that the lunch counter is rather favorable to health than to disease, and is of opinion that the health of troops is not injured by the drinks sold there. In cases of alcoholism at his post, the condition has resulted, in almost every instance, from drinks obtained at outside saloons.

Major Girard has observed that some men drink too much beer after pay-day, but would probably resort to stronger drinks if they went outside.

Majors De Witt and Lippincott report no ill effects.

Capt. Ebstein, 21st Infantry (Plattsburgh Barracks), who, with a few captains of his regiment, established as an experiment a Canteen in 1881, and who subsequently, under the direction of the War Department, investigated the subject at various posts, thus writes me:

* * * The Canteen has become an important and firm fixture in our post administration, replacing by a co-operative system the extortionate and demoralizing post trader's establishment. Pay-day, which a few years ago was a synonym for debauchery and riotous disturbance, when discipline was practically suspended for several days, is now undistinguishable from any other day, and the sick report is decidedly free from cases of alcoholism that used to infest it. Where, in 1885, in my company there were lost to the Government 852 days by sickness, and 804 days by arrest and confinement, there were in 1894, with an average strength of enlisted men thirty-five per cent greater than in 1885, but 455 days lost by sickness and 205 by arrest. That the Canteen system has added greatly to the contentment of the soldier is beyond question.

The most ardent advocate of the Post Exchange could not desire more favorable testimony than the above. Commendation is *unanimous*, and any who are in doubt about, or in opposition to, the institution on temperance grounds must now admit that there are good reasons for friendliness toward the new order of things.

The question, is it an advantage to the men to have the ration supplemented by a cheap lunch at the Exchange, may depend somewhat upon circumstances; but experience demonstrates, in the main, that it is an advantage. It is entirely optional with the men whether or not they shall partake of a lunch at the Exchange, and, as a rule, they do not eat when they are not hungry, especially if they have to pay for the food. It sometimes happens that an article of diet at the mess, although wholesome and palatable to many, is distasteful to a few, owing to idiosyncrasy. Let us suppose, for instance, that onions have been used in preparing a dish for supper, or that liver and bacon have constituted the chief part of the meal. A few find these dishes distasteful, and as supper is called at 5 o'clock and tattoo sounds at 11 o'clock, six hours inter-

vene before bed-time. The result would be that some would go hungry to bed, or to a tour of guard, unless a place where refreshment might be obtained as occasion required were at their command. Then again, if walking guard in a malarious region at night, hunger would predispose the system to an attack of intermittent fever.

Major Girard observes that young men, as a rule, have hearty appetites, and the meals furnished by the Government are at times insufficient to carry them from one to another.

Major Adair suggests that the increased variety of diet afforded by the lunch counter may supply required nutritive elements that are not present in due proportion in the ration, and so do away with the necessity of gourmandizing to obtain them.

Major De Witt believes the lunch counter to be an advantage, provided good, well-cooked food is furnished. Many articles not furnished at the regular mess are obtainable, and thus the monotony that often pertains to the company table is broken. Then, too, he suggests that the money spent in that way might otherwise be thrown away in a foolish or harmful manner.

Major Heizman points out the fact that the bulk of the enlisted force of the Army is composed of young men, and they require food at shorter intervals than is allowed at the regular mess. Especially after unusual exercise, as during the target season, the Exchange is uncommonly well patronized.

Major Byrne believes it to be an advantage to the service to have the ration supplemented by a good, cheap lunch.

Capt. Birmingham observes that a man who takes a glass of beer, and with it a sandwich, is much less liable to crave another glass than a man who takes the beer alone.

Major Cleary, while inclined to think the ration sufficient, as a rule, still, on the whole, regards it as an advantage to give the soldier an opportunity to get a lunch at a nominal cost.

Other correspondents answer simply in the affirmative, *i. e.*, that it conduces to the health of troops to supplement the ration.

No case of illness from eating too heartily at the Exchange has fallen under my observation, and I can think of no valid objection to urge against the propriety of permitting healthy young men the opportunity of getting a lunch when they crave it. Undoubtedly,

there are men whose voracious appetites stop at nothing short of excess, and who eat when opportunity offers more than required for health, but such cases are exceptional. The nutritive wants of men differ so radically that what would be repletion for one might be insufficient for another, and the lunch counter is a salutary provision for the latter class. I think we may safely regard the lunch counter as a necessary adjunct of the Exchange, and feel that any rare instance of its abuse is much more than counterbalanced by the many cases in which it does good.

Malingering, which formerly, in my experience, was very common in the Army, has almost wholly disappeared. Not a case has been observed by myself in the entire 21st Infantry since its concentration at Plattsburgh Barracks seven months ago. But a few years ago feigned illness was a chronic evil in the service, and constant watchfulness on the part of medical officers was required to guard against it. Now, apparently, only genuine cases of sickness apply for treatment, and even among them there appears to be a reluctance to go upon the sick report. This is certainly an indication of greater contentment among the men and improved *morale* generally. That it is to be attributed to the action of several causes is true, but among them the Post Exchange stands out as one of the most influential.

We have so far considered chiefly the benefits to health conferred by the Exchange, which we have seen to be many and substantial. It is not claimed that it is an ideally perfect institution. It is undoubtedly susceptible of some improvement. As experience is obtained changes for the better perhaps will be made. Two impediments to a perfect operation of the Exchange are to be found, existing singly or together, at a few posts: First, in imperfect facilities; and second, in faulty arrangements. An act of Congress, making appropriations for the support of the Army for the fiscal year ending June 3, 1893, contains a proviso prohibiting expenditure of any money appropriated for the Army for post exchanges. Now, inasmuch as the Government established the Canteen for the improvement of the service, it would but seem but a natural obligation resting upon it that it should extend to the institution its material aid and support, especially in its early struggle for existence. While the financial

support of the Government would facilitate the good work of the Exchange, and insure uniformity of method throughout the service, still, upon the present lines of evolution, the full development of the system will be reached in the course of time; but it will require longer time, and be attended with more uncertainty. As an example of the vitality of the Exchange, I may cite its establishment at Plattsburgh Barracks, New York, where, in six months, without any Government aid whatever, it erected its own buildings, purchased its own stock, and practically extinguished its own debt. (See letter from Lieut. J. Y. Stamper, 21st Infantry, attached. Appendix B.) In addition to this, its financial aid was indispensable to the success of the general mess.

A wide diversity exists at different posts between the buildings occupied by post exchanges, ranging all the way from canvas or dilapidated and illy contrived rookeries to fairly well-built and commodious structures. A suitable home for the Exchange is necessary to a perfect arrangement of its business and workings.

Considerable difference between the several posts is also to be found in the character of commodities dealt in, and in the facilities for amusement and recreation. It is obviously the desideratum to supply an attractive rendezvous at which rational and profitable occupation of leisure time may be encouraged. If the beer-selling feature is given undue prominence the better and essential character of the resort suffers, and it is shorn of much of its power to attain its legitimate ends. A tendency to stimulate the sale of beer to increase the company fund has been complained of, but, happily, this practice was exceptional, and under a better apprehension of the Exchange is becoming extinct. The present Exchange Council, as constituted by paragraph 333, Army Regulations, is composed of the line officer next to the commanding officer, the company commander next in rank, and the Exchange officer. It might be expedient to add the post surgeon as an additional member, for the purpose of receiving his recommendations concerning the quality and variety of food to be kept at the lunch counter, and other sanitary questions that might arise.

By a decision of the Secretary of War (Cir. 13, 1891), the sick in hospital are excluded from receiving any share of the profits of the Exchange. This is spoken of by Major Waters as a defect in the system. About four years ago I invited the attention of the War

Department to the matter, requesting a reconsideration of the decision, but this was denied. There are many reasons why it would be of advantage to the sick to have the hospital fund increased by a dividend based upon the whole aggregate occupancy of the hospital during the month. The men of the Hospital Corps receive a share of the profits, a portion of which is necessarily used by the sick. This does not appear equitable, as frequently the cost of subsisting the sick is greater than the amount expended for the well. Besides, in many cases, the sick contribute to the profits of the Exchange. There are many other strong arguments in favor of a reversal of the decision, and none that appear to be of sufficient weight to warrant its continuance.*

The destiny of the Post Exchange in the event of war is an interesting medico-military problem to which I have given some thought, and one which I think offers but few difficulties to solve. I believe it could be easily adapted to such an emergency and made to perform a useful function, but its discussion does not appear to be germane to the present occasion.

I trust I have succeeded in outlining, during the course of this paper, the features of the Post Exchange that are of value and deserving of promotion, as well as suggesting certain modifications that might redound to its improvement. That it has done and is doing good work is unmistakable, and that it is capable of enlarging its range of usefulness must be evident to one who has seriously considered its capabilities. As a matter of fact, it is already a dangerous competitor of the Subsistence and Quartermaster's Departments, supplementing them in a narrower sense, but in a broader sense having a developmental capacity of entirely superseding them in their functions of local supply. Already we hear of the Exchange, in some places, selling clothing, underclothing, and shoes of better quality and at cheaper rates than supplied by the Government. The same holds good with relation to some articles of subsistence.

Now, what, in brief, should we try to realize in future from the Post Exchange? It should be the efficient agency to secure physical development by gymnastic exercises; to encourage the improvement of the mind and disposition by restraining from vicious propensities; to promote contentment and health by feeding and clothing the body

*Since the preparation of this paper the change here referred to has been made.—ED.

as it should be. To raise, in short, the standard of manhood, in morality, dignity, and fortitude. But restraining too sanguine an estimate of the future possibilities of the Post Exchange we can discern in it a promise of vast amelioration to the enlisted soldier, and possibly a welding of the interests and activities of the Army into a perfect solidarity.

My sincere thanks are due and are hereby tendered to all the gentlemen named in this paper, who have so kindly aided me by suggestions and information in its preparation.

APPENDIX A.

PLATTSBURGH BARRACKS, NEW YORK, April 4, 1895.

TO THE ADJUTANT-GENERAL, U. S. ARMY, WASHINGTON, D. C.

Sir—I have the honor to ask to be informed as to the number and names of garrison posts in the Army at which post exchanges are in successful operation, and the number and names of posts at which post trader's establishments are still maintained. If practicable, I should like also to be advised as to the amount of receipts and expenditures of the Post Exchange at each of twelve posts taken at random, for the year 1894, and also the grand total of receipts and expenditures at post exchanges throughout the Army for the same period.

Very respectfully, your obedient servant,

P. F. HARVEY, *Major and Surgeon*, *U. S. A.*

LIST OF MILITARY POSTS AT WHICH THERE WERE EXCHANGES, DECEMBER 31, 1894.

Adams, R. I.	Columbus, N. Y.	Logan, Colo.
Alcatraz Island, Cal.	Custer, Mont.	Madison Barracks, N. Y.
Apache, Ariz.	D. A. Russell, Wyo.	Mason, Cal.
Assiniboine, Mont.	Davids Island, N. Y.	McHenry, Md.
Barrancas, Fla.	Douglas, Utah.	McIntosh, Tex.
Bayard, N. Mex.	Duchesne, Utah.	McPherson, Ga.
Benecia Barracks, Cal.	Grant, Ariz.	Meade, S. Dak.
Bliss, Tex.	Hamilton, N. Y.	Missoula, Mont.
Boise Barracks, Idaho.	Hancock, Tex.	Monroe, Va.
Brady, Mich.	Huachuca, Ariz.	Myer, Va.
Buford, N. Dak.	Benecia Arsenal, Cal.	Niagara, N. Y.
Canby, Wash.	Jefferson Barracks, Mo.	Niobrara, Neb.
Clark, Tex.	Keogh, Mont.	Omaha, Neb.
Columbus Barracks, O.	Leavenworth, Kas.	Plattsburgh Bks., N. Y

Porter, N. Y.	Sherman, Idaho.	Warren, Mass.
Preble, Me.	Sill, Okl. Ter.	Washakie, Wyo.
Presidio San Fran., Cal.	Snelling, Minn.	Washington Bks., D. C.
Reno, Okl. Ter.	Spokane, Wash.	Wayne, Mich.
Riley, Kas.	Stanton, N. Mex.	West Point, N. Y.
Ringgold, Tex.	Thomas, Ky.	Whipple Barracks, Ariz.
Robinson, Neb.	Townsend, Wash.	Willets Point, N. Y.
Rock Island Arsenal.	Trumbull, Conn.	Wingate, N. Mex.
Sam Houston, Tex.	Vancouver Bks., Wash.	Yates, N. Dak.
Schuyler, N. Y.	Wadsworth, N. Y.	Yellowstone, Wyo.
Sheridan, Ill.	Walla Walla, Wash.	Watervliet Arsenal.

MILITARY POSTS AT WHICH THERE WERE TRADERS, DECEMBER 31, 1894.

Fort Apache, Ariz. Fort Duchesne, Utah. Fort Washakie, Wyo.

RECEIPTS AND EXPENSES AT FOLLOWING-NAMED EXCHANGES, FOR YEAR 1894.

	Receipts.	Expenses.
Fort Assiniboine, Mont.,	$49,979.39	$41,558,26
Fort Buford, N. Dak.,	36,947.73	28,201.66
Columbus Barracks, Ohio,	16,954.21	14,143.04
Fort Custer, Mont.,	79,110.24	68,902.58
Fort Grant, Ariz.,	58,244.28	44,325.89
Fort Keogh, Mont.,	37,106.00	28,767.10
Fort Leavenworth, Kas.,	30,263.77	20,412.13
Fort Reno, Okl. Ter.,	29,690.43	19,581.04
Fort Sill, Okl. Ter.,	47,458.57	39,334.51
Fort Sheridan, Ill.,	29,948.83	24,663.88
Fort Wingate, N. Mex.,	39,006.64	31,411.64
Fort Yates, N. Dak.,	32,214.25	20,223.81
At all Exchanges,	$1,417,079.62	$1,106,432.51

ADJUTANT-GENERAL'S OFFICE, April 12, 1895.

APPENDIX B.

PLATTSBURGH BARRACKS, N. Y., March 6, 1895.

MY DEAR DOCTOR:

I enclose herewith the list of sales made in the Exchange during the months of December, January, and February, and a statement of the cash and credit taken in, and credit issued. This comprises all the data, I think, you desired. The great decrease in lunches sold I attribute to the better

food furnished by the mess, and I was much pleased to see it, and think the falling off will be still more marked during the next few months. The increase in the amount of beer and ale sold I am inclined to believe is beneficial also, and would be glad to see it double itself, showing as it does that the Exchange is increasing its customers, and that there is less *outside* drinking. My chief end and aim, while I was Exchange Officer was to add every article and comfort I could, and to seek the patronage of the men of the garrison, with the end in view that they would frequent the Exchange more and the saloons less. An Exchange Officer at this post is greatly hampered by the lack of funds to erect a suitable building wherein to conduct the business of the institution, and I consider that it is obligatory on the Government, having instituted the Exchange, to so foster it in its infancy at a post that the lack of a proper building would not retard its progress *in its infancy*. For its first year it is necessarily weak, but after that period it should ask help from no one if properly conducted.

I have watched the workings of the Exchange at this post for the past month and three-fourths with deep interest, and am convinced that it could be made a large dividend-paying institution; that it would be also able to furnish every one in the post with all articles of food and of household use at far less than the curreut market price, besides furnishing to the enlisted men a club. In other words, the Exchange, to arrive at full maturity, should become the co-operative store of a garrison, and enter into active competition with the Subsistence Department. By this plan I believe that a *home interest* could be fostered in a garrison, and by degrees the Exchange would become not only a moneyed power but a *true club* for the men, where they could purchase, from their small pay, everything from a pin to their daily meat and bread.

By the issue of credit checks direct from the Exchange, as is now being done, an Exchange Officer becomes familiar with the patrons of the Exchange, and by his constant presence (uecessarily) there on busiuess he soon finds out who abuses the privilege at the bar. A withholding of privileges will soon bring such a man to terms, especially so if the Exchange is made a *very desirable* resort. No man likes to be cut off from the same enjoyments as his fellows, and this treatmeut would be as efficacious as the "gold cure," and would tend to make the Exchange an "educator." Could it be done, the Exchange should be made decidedly co-operative, every enlisted man and officer in the garrison being a shareholder to a stated extent (if desired), and dividends paid iu the same manner as other corporations, after deductions being made of a stated sum for the improvement of the men's mess. Could this state of affairs be reached, I think the Exchauge would become the most powerful institution in the Army. I think this answers about the questions you desired answered, and I am glad to be of service, if an expression of any opinion, which is purely personal, can be of service.

I am sir, very truly yours,

W. Y. STAMPER.

SALES, ETC., OF THE POST EXCHANGE, PLATTSBURGH BARRACKS, NEW YORK.

ARTICLES.	1894. December.	1895. January.	1895. February.	Total.
Lunches—10c. to 25c	$339 75	$260 34	$251 90	$851 99
Cigars—5c. to 10c	108 15	171 75	141 90	421 80
Tobacco—From 20c. to 60c. per pound	61 50	63 00	62 90	187 40
Notions — Perfumery, brushes, etc., various prices	19 35	26 60	37 75	83 70
Candy—30c. and 40c. per pound	2 45	20 85	20 30	43 60
Pipes—Clay, briar, imt. meerschaum, from 1c. to $1 . . .	. . . . . .	12 25	13 00	25 25
Dry Goods—Suspenders, handkerchiefs, etc., various prices.	. . . . . .	3 90	19 50	23 40
Stationery — Paper, envelopes, stamped envelopes, etc . . .	1 60	5 05	11 55	18 20
Stamps—U. S. postage	. . . . . .	3 57	18 90	22 47
Beer and Ale—5c. per glass . .	474 15	570 25	583 05	1,627 45
Soft Drinks—Cider, pop, etc .	6 65	2 40	16 20	25 25
Totals	$1,013 60	$1,119 96	$1,176 95	$3,330 51
Cash taken in	635 20	677 50	634 85	1,947 55
Credit taken in	377 65	462 45	544 85	1,384 95
Credit issued	306 50	414 00	494 25	1,214 75
Totals	$1,319 35	$1,553 95	$1,673 95	$4,547 25

	December.	January.
Cash and credit taken in, increase February over January and December	$166 85	$39 85

December receipts	$853 90
November receipts	593 97
December increase	$259 93
January receipts	$1,097 76
December receipts	853 90
January increase	$243 86
February receipts	$1,526 00
January receipts	1,097 76
February increase	$428 24

THE RELATION OF CONCENTRATED FOODS TO ACTIVE SERVICE DEMANDS.

BY MAJOR CHARLES SMART, Surgeon, U. S. Army.

A discussion of the subject which forms the title of this paper is one into which there enters little but the well-known principles of dietetics, as applied to the consideration of an emergency ration for soldiers. Its literature is meager. To Col. Babcock, of the Military Information Bureau of the War Department, the writer is indebted for information concerning the ration of foreign armies, and to Major Woodruff, of the Subsistence Department, concerning that of our own service.

The necessity for an emergency ration seems to be accepted by military men, since we find it provided for troops in active service in the armies of most of the nations of Europe. Occasions arise when it is of importance to maneuver troops for a few days at a time independent of delays in issuing rations prior to the movement. Whether troops in campaign should be required to carry an emergency ration at all times, or whether the ration should be issued only when there is an expectation of special service, involving separation from the wagon train, is a question for the military authorities to settle. In any event the ration should be as compact and light as is consistent with the properties needful for its special purpose.

We are all familiar with the average daily water-free diet required for an adult man in laborious work, or for a soldier on service in the field. The military ration of the United States has more variety than that of any other nation. Its principal constituents are fresh beef, flour, beans, potatoes, onions, coffee, and sugar; but for each of these may be substituted others of about equal financial and nutritive value. Fresh beef, for instance, may be replaced by mutton, pork, bacon, salt beef, and fresh, dried, or pickled fish. The force value of the ration necessarily varies with the articles selected for

the calculation. Taking the basic constituents, as above stated, the ration consists of:

Protein, ...	6.9 oz. or 193.5 gm.	= Nitrogen 475 grs.	= Calories 3,442
Fat, ...	1.0 oz. or 28.3 gm.	Carbon 5,926 grs.	
Carbohydrates,	20.5 oz. or 580.1 gm.		

Or, if bacon be substituted for fresh beef, the nitrogenous element would be lessened, while the carbon and potential energy would be increased materially.

Protein, ...	3.7 oz. or 104.7 gm.	= Nitrogen 255 gms.	= Calories 4,992
Fat, ...	8.3 oz. or 234.9 gm.	Carbon 7,700 gms.	
Carbohydrates,	20.5 oz. or 580.1 gm.		

Moleschott's standard diet has been accepted by students of this subject as presenting the required combination of alimentary principles for the maintenance of health in a person of average height and weight in a temperate climate, and with a moderate amount of work. It consists of:

Protein, ...	4.6 oz. or 130 gm.	= Nitrogen 316 grs.	= Calories 2,970
Fat, ...	3.0 oz. or 84 gm.	Carbon 4,860 grs.	
Carbohydrates,	14.3 oz. or 404 gm.		

The diet of the soldier is necessarily in excess of this. Parkes and DeChaumont have given a maximum and a minimum. The one consists of:

Protein, ...	6.0 oz. or 170 gm.	= Nitrogen 412 grs.	= Calories 3,472
Fat, ...	3.5 oz. or 100 gm.	Carbon 5,664 grs.	
Carbohydrates,	16.0 oz. or 450 gm.		

The other contains:

Protein, ...	7.0 oz. or 200 gm.	= Nitrogen 486 grs.	= Calories 4,120
Fat, ...	4.5 oz. or 130 gm.	Carbon 6,724 grs.	
Carbohydrates,	18.0 oz. or 510 gm.		

An extensive experience of such rations has demonstrated their competency to sustain the system of the soldier under the fatigues of a campaign, so that there was hardly needed the experimental proof made by a British Army surgeon, to the effect that men undergoing hard labor did not lose weight when sustained by a daily allowance of 300 grains of nitrogen and 5,300 grains of carbon.

The ordinary diet is of interest in our present inquiry, as showing the maximum of an emergency ration. Less quantities will certainly meet the requirements of the emergency, for if men are in good

condition they can exert their utmost powers on short rations for a few days at a time, losing weight, of course, by supplementing the deficient dietary from their own tissues; but this loss may easily be repaired when the emergency is ended. To enable them to exert their best energies they must, however, be prevented from experiencing the feeling of hunger, or even any depression of spirit induced by a shortage of food.

The minimum of the emergency ration is marked out by Playfair's subsistence diet, or that needful to carry on the internal work of the human system:

Protein, ...	2.0 oz. or 56.6 gm.	=	Nitrogen 137 grs.	= Calories 1,758
Fat, ...	0.5 oz. or 14.2 gm.		Carbon 2,970 grs.	
Carbohydrates,	12.0 oz. or 340.0 gm.			

Although the emergency ration evidently lies between these extremes, it will not be obtained by a limited pro rata reduction of the alimentary principles of the ordinary ration. Fats and carbohydrates are, to a large extent, interchangeable in a dietary, but neither can take the place of the nitrogenous principle in repairing the wastes of muscular action. Any reduction should be at the expense of the carbon, leaving the protein of the emergency ration equivalent, as in the ordinary ration, to at least 300 grains of nitrogen, or represented in terms as above:

Protein, ...	4.2 oz. or 120 gm.	=	Nitrogen 300 grs.	= Calories 492
			Carbon 987 grs.	

To this has to be added carbon in quantity sufficient to bring the potential energy of the ration up to and beyond the minimum, or that present in Playfair's subsistence dietary. How far beyond this minimum it is needful to carry the increment can be learned only by an inquiry into the composition of those emergency rations that have been used with satisfactory results.

Variety in diet is essential to vigor of system, but as the emergency ration is intended to be used only at times and for short periods, there is no need to consider variety if the needful quantity of the alimentary principles be provided. The ration itself is a change from the usual dietary. Nor is there need to consider an anti-scorbutic element in its composition. The regular diet of the troops should be such as to prevent the occurrence of any scorbutic tendency from an occasional restriction to the emergency ration.

Theoretically, the alimentary substances best suited for this special ration are those which contain the highest percentages of the proximate principles. The water-free food of the text-books on dietetics would be the best emergency ration were it susceptible of easy reduction from its dry and preserved condition into a palatable mass permeable to the secretions of the digestive organs and available for assimilation. Looking over the tables of analyses of various substances used as food, those may readily be selected that will give relatively the largest supply. The following tabulation presents the percentages of nitrogen and carbon in certain of these substances; also, their percentages of protein, fats, and carbohydrates, with their relative value as force-producers; and lastly, their relative cost, calculated from market prices furnished by the Subsistence Department of the Army:

	PERCENTAGE OF					Calories per 100 gm.	Cents per 1,000 Calories.
	Nitrogen.	Carbon.	Protein.	Fats.	Carbo-Hydrates.		
Roast beef, ...	4.36	26.91	27.6	15.5	....	257	7.73
Chicago pressed beef,	6.32	21.32	40.0	15.0	....	303	5.60
Dry bacon, ...	1.39	62.60	8.8	73.3	....	694	2.07
Butter, ...	.16	67.90	1.0	85.0	.5	797	8.04
Oleomargarine, . . .	.09	66.75	.6	84.5	....	788	4.48
Lard, ...	....	78.21	....	99.0	....	921	1.98
Cheese, whole, . . .	4.28	43.50	27.1	35.5	2.3	451	5.87
Cheese, skim, ...	6.07	29.79	38.4	6.8	8.9	257	6.87
Beans, ...	3.66	39.50	23.2	2.1	57.4	350	1.89
Peas, ...	3.47	36.83	22.0	2.0	53.0	326	2.09
Oatmeal, . . .	2.38	43.90	15.1	7.1	68.1	360	2.45
Maize, ...	1.44	39.37	9.1	3.8	71.0	364	1.04
Rice, ...	.79	40.23	5.0	.8	83.2	369	2.93
Desiccated potatoes, .	.84	37.04	5.3	.3	83.5	367	3.60
Wheat flour, ...	1.74	40.30	11.0	1.1	75.6	365	.91
Biscuit, ...	2.46	41.92	15.6	1.3	73.4	377	2.64
Sugar, ...	.....	42.93	....	....	96.7	396	2.03

The 300 grains of nitrogen which we have already recognized as the basis of the emergency ration may be obtained from cheese, roast or pressed beef, beans, or peas; the carbon to supplement it, from the fats, farinas, and sugars. In considering this selection there are two points of importance to be remembered: 1. That the potential energy of fat is more than double that of the carbohydrates. Fat is, therefore, a desirable ingredient of an emergency ration. 2.

That when fat in excess of the quantity ordinarily used by an individual is taken into the system a certain part of it will probably fail to be assimilated. In the average of a large number of diets for moderate exercise, as calculated by various authorities, the relative proportions of the several proximate principles are protein two, fat one, and carbohydrates seven. In diets for hard labor, besides an increased total, the relative quantity of fat also is increased. The actual quantity of fat in Parkes' soldier's ration is from 3.5 to 4.5 ounces. The bacon ration of the U. S. soldier contains more, but it is well known that it is seldom all consumed. The maximum of fat in the emergency ration may be deduced from these considerations.

Our information concerning the emergency ration of the British service is meager. It is said to consist of Chicago pressed beef in tins, and a "vegetable preparation," composed of two-thirds potatoes and one-third peptonized meat. As it weighs only twelve ounces, it must be an exceedingly spare diet. It probably provides the needful quantity of nitrogen, and is deficient only in that which may be borrowed temporarily from the tissues of the individual. Granting that the whole of it has the high value of the pressed beef, it would yield only,

$$\left.\begin{array}{l}\text{Protein, ... 4.8 oz. or 136 gm.}\\ \text{Fat, ... 1.8 oz. or 51 gm.}\end{array}\right\} = \left.\begin{array}{l}\text{Nitrogen 332 grs.}\\ \text{Carbon 1,741 grs.}\end{array}\right\} = \text{Calories 1,032}$$

Some English manufacturers have produced a campaign ration that is said to have given satisfaction. That of Maconochie Brothers, of Lowestoft, consists of cooked meat with preserved soup, cocoa, milk, and sugar. It weighs one pound eight ounces. As the cocoa can be prepared with cold water, the soup is the only part of this ration which requires to be cooked. This can be done in the tin in which the ration is contained. The sealed tin is about the size of a cartridge box, and has two rings by which it may be carried on the belt. From the statement of its constituents and weight it is necessarily a more generous ration than that described as the regulation emergency ration. C. Prevet & Co. have, among other articles on the market, an emergency field ration consisting of peptonized meat and potato compressed. This is probably the source of the "vegetable preparation" used in the military service.

Either the Geman ration, or our information concerning it, is markedly defective. Its nutrients weigh only ten or eleven ounces,

and at their best give barely the nitrogen of a subsistence diet, while its force value is far below that needful to carry on the vital processes of the organism. It can be characterized only as a starvation diet, endured for a special purpose. Enthusiasts might be effective after three days of such a ration, and troops under an iron discipline might reach the place where they were wanted, but in no condition to cope with an enemy of equally good physique on full rations. The allowance for three days is reported as consisting of 17½ ounces of biscuit, seven ounces of pressed meat (or six ounces of bacon), 4½ ounces of rice (or 8¾ ounces of meal), ⅞ ounce of coffee, and ⅞ ounce of salt. Total, with packing, about two pounds four ounces. The meat is preserved in tins which, with the other articles, are carried in a flat ration bag lying behind the knapsack and under its flap. The nutritive value of one day's ration is:

Protein, ...	1.92 oz. or 54.6 gm.	= Nitrogen 133 grs.	= Calories 985
Fat, . . .	.44 oz. or 12.4 gm.	Carbon 1,680 grs.	
Carbohydrates,	5.56 oz. or 157.7 gm.		

With bacon instead of meat the units of energy are increased to 1,132. The reserve ration of the French service is one of the most liberal. It is a two day's ration, and weighs 2.1 kilos, or four pounds ten ounces. It is said to consist of 42.3 ounces of hard bread, 17.6 of preserved meat, seven of rice, 1.4 of salt, 2.2 of sugar, 1.7 of coffee, and 1.8 of condensed soup. Making due allowance for the uncertain composition of the last-mentioned article, the value of the ration for one day would be as follows:

Protein, ...	7.35 oz. or 208 gm.	= Nitrogen 507 grs.	= Calories 3,581
Fat, ...	1.76 oz. or 50 gm.	Carbon 6102 grs.	
Carbohydrates,	19.5 oz. or 552 gm.		

This is a generous diet for hard labor, but its force value could evidently be increased without altering its weight by increasing the fat at the expense of the other principles.

The materials of the Austrian emergency ration weigh 26½ ounces, but each man carries also two rations of salt and tobacco, the former two ounces, the latter 2.4 ounces. This ration is also quite generous, giving

Protein, ...	6.31 oz. or 178.8 gm.	= Nitrogen 436 grs.	= Calories 2,649
Fat, ...	1.57 oz. or 44.4 gm.	Carbon 4,532 grs.	
Carbohydrates,	12.96 oz. or 367.8 gm.		

The Swiss soldier carries emergency rations for two days. Their weight is 42.2 ounces, consisting of 17.6 ounces of meat in tins, as much biscuit, and seven ounces of pea or bean meal tablets. The value of the quantity for one day may be represented as follows:

$$\left.\begin{array}{ll} \text{Protein, ...} & \text{5.68 oz. or 160.7 gm.} \\ \text{Fat, ...} & \text{1.51 oz. or 42.7 gm.} \\ \text{Carbohydrates,} & \text{8.39 oz. or 237.9 gm.} \end{array}\right\} = \left.\begin{array}{l} \text{Nitrogen 392 grs.} \\ \text{Carbon 3,472 grs.} \end{array}\right\} = \text{Calories 2,031}$$

Our information concerning the two days' Portuguese emergency ration is meager; but as it weighs fifty-two ounces, and consists of biscuit, sausage, coffee, and sugar, it must be a fuller ration than that of the Swiss troops.

In our own Army we have had but little experience of concentrated food or emergency rations. To the knowledge of the writer the only instance of which we have a record is one in which he participated personally. In 1867 Troop E, First Cavalry, Captain Sanford, was for six days of a scouting expedition in the Mazatsal Mountains, Arizona, on rations of dried beef, pinole (a ground mixture of maize and mesquite beans), and sugar. The object was not to test the value of an emergency ration, but to free the command from the incumbrance of a pack-train, and to enable it to camp without discovering its position to the Apaches by the light or smoke of camp fires. Each man carried his ration on his saddle, about six pounds of the mixed pinole and sugar, and three pounds of the dried beef. The command enjoyed the change to this primitive mode of subsistence, common enough among the Mexicans when on travel or on war service, but this lasted only for a day or two until the novelty wore off. None suffered from hunger or loss of energy, but all were pleased to find the pack-train at the appointed rendezvous, and for a time regarded pork, hard bread, and a mug of coffee as dainties hitherto grossly unappreciated.

In 1891 Lieut. W. C. Brown, Troop C, First Cavalry, made trial of some of Weidner's tablet soups, as prepared by a manufacturing company—the American Ready Food Co.—then, but not now, in existence. The intention appears to have been rather to determine the keeping qualities, portability, and palatability of the tablets, with the view of considering them as a substitute for some part of the vegetable ration, rather than to test their sustaining qualities as an emergency ration. This officer states in his report: "At the

time when the most thorough test was made I had charge of a small party of ten persons in the Rocky Mountains, in October last (1891). Three of the party were officers, three civilians, the others soldiers. All messed together. We were in the mountains for about ten days, and as it rained and snowed a great part of the time our appetites were keen. We had nearly all the components of the ordinary field ration (except vegetables), supplemented for about three days of the ten by a limited quantity of officers' supplies, such as chocolate, ham, cheese, etc.; for about a week, however, we had simply bacon, hard bread, coffee, sugar, and these soups. We had chocolate in lieu of coffee perhaps twice during this time. There was but one camp kettle in the party, and we were accordingly able to prepare but one liquid article of diet at a time. The result was that we alternated, having coffee (or chocolate) one meal and soup the next. We thus consumed a greater proportion of soup than we would have done had our supply of cooking utensils been greater; but I notice that we did not tire of it."

Each tablet was two and a half inches square by three-fourths inch thick, weighed four ounces, and was said to be a combination of pea-flour and bouillon extract, yielding, if cooked for twenty minutes, three pints of palatable and nutritious soup; cost, by wholesale, six cents per tablet. There is no doubt from this report that such tablets would form an excellent portion of an emergency ration, for, as Lieut. Brown says: "The soldier in the field always carries his tin cup, and if he is allowed or required to keep a soup tablet in his haversack or saddlebag he need never go to bed supperless, no matter when the wagons come into camp."

The kola nut has been attracting attention lately as possibly of value in emergencies; but it can hardly be considered an article of food.

The Commissary-General of Subsistence of our Army has, for some time back, had the subject of an emergency ration under consideration, and in a recent letter (April 17, 1895) to the Adjutant-General he endeavors to enlist the interest and co-operation of line officers in this matter. He recommends the convention, in each military department, of a board consisting of one subsistence, one medical, and three line officers, to consider and report on various points connected with the elaboration of the best emergency ration.

1. Its component parts; having reference to portability, wholesomeness, and proper nutritive value. 2. Palatability. 3. Keeping qualities. 4. Kind, size, form, and weight. 5. Directions for use. 6. Number of rations to be carried. 7. Whether to be carried by the soldier as a part of his equipment, or to be issued only on occasions of possible emergency. He desires, also, to place funds in the hands of each board to defray expenses of experimentation.

Meanwhile, as the result of personally conducted experiments, Major Woodruff, C. S., under the direction of the Commissary General, has suggested two forms of ration, one of which might be called an iron ration, since this term appears to have been accepted by military men as expressive of an inadequate diet, and the other an emergency or campaign ration. Of the former it is proposed that an allowance for three days be carried on the belt, in a sealed tin, or aluminum, which can be opened readily and used as a cooking cup; gross weight, two and a half pounds. The ration for one day consists of five ounces of oatmeal or corn-meal crackers (meal four ounces, suet one ounce), five ounces of soup-tablet (dried beef two ounces, pea-meal, desiccated potatoes, and suet, each one ounce), one-third ounce extract of coffee as a wafer, moistened with saccharine, and one-fourth ounce salt. When the biscuits are of oatmeal, the value of this ration is as follows:

Protein.	2.2 oz. or 62.3 gm.	=	Nitrogen 152 grs.	= Calories 1,364
Fat	2.5 oz. or 70.7 gm.		Carbon 2,218 grs.	
Carbohydrates .	4.1 oz. or 116.0 gm.			

When they are composed of corn meal their value is changed to:

Protein, . . .	1.94 oz. or 54.9 gm.	=	Nitrogen 134 grs.	= Calories 1,331
Fat, ...	2.35 oz. or 66.5 gm.		Carbon 2,080 grs.	
Carbohydrates,	4.20 oz. or 118.9 gm.			

Each of these, like the German iron ration, contains the nitrogen of a subsistence diet; but each has the advantage of the German article in furnishing more of the carbonaceous elements. Palatability and keeping qualities must be determined by experience.

Major Woodruff proposes to put up the second or campaign ration in cans to be carried on the belt or in the blanket roll, each can weighing three pounds, but containing rations for only two days. One ration consists of ten ounces of oatmeal or corn-meal crackers (meal eight, suet two ounces), twelve ounces of soup tablets (dried

beef four, desiccated potatoes two, pea-meal and suet each three ounces), one ounce extract of coffee, with sugar and milk, and ¼ ounce salt. The value of this ration, with oatmeal crackers, is expressed as follows:

$$\left.\begin{array}{lll}\text{Protein, . . .} & \text{4.67 oz. or 132.2 gm.}\\ \text{Fat, ...} & \text{5.08 oz. or 143.7 gm.}\\ \text{Carbohydrates,} & \text{9.11 oz. or 257.8 gm.}\end{array}\right\} = \left.\begin{array}{l}\text{Nitrogen 323 grs.}\\ \text{Carbon 4,613 grs.}\end{array}\right\} = \text{Calories 2,935}$$

With oatmeal crackers:

$$\left.\begin{array}{lll}\text{Protein, . . .} & \text{4.20 oz. or 118.8 gm.}\\ \text{Fat, ...} & \text{4.81 oz. or 136.1 gm.}\\ \text{Corbohydrates,} & \text{9,34 oz. or 264.3 gm.}\end{array}\right\} = \left.\begin{array}{l}\text{Nitrogen 289 grs.}\\ \text{Carbon 4,454 grs.}\end{array}\right\} = \text{Calories 2,836}$$

It may be observed that nothing is gained by the substitution of corn meal for oatmeal unless we except greater palatability, but the possession of this by the corn meal remains to be demonstrated.

Concentration in this ration is effected on physiological and physical lines—physiologically, by furnishing as much as possible of the carbon in the form of fat without going beyond the quantity ordinarily assimilated by soldiers under the conditions of active service; physically, by the greatest possible elimination of water without impairing the quality of the nutrient elements. This ration gives the full allowance of nitrogen for active service, and its force value is equal to that of Moleschott's standard diet, although its weight is considerably less.

The presence of a certain proportion of water in food supplies constitutes one of the conditions facilitating putrefaction. By eliminating their water, articles of subsistence are not only lessened in bulk and weight, but at the same time preserved. Preservation in the proposed ration is to be accomplished by sealing in tins of suitable size and shape. The exclusion of air after sterilizing by heat is now so cheap a process that many of the nations issue the emergency ration in sealed tins. Canned supplies were originally regarded as luxuries, but they are really, in many instances, cheaper than fresh goods. Chicago canned meat is equal in nutritive value to more than double its weight of uncooked meat; and the former costs only eight cents per pound, the latter nine cents. Besides a lessened cost of transportation, the canned stores save all that is lost by decomposition in dealing with fresh supplies. A canned Bavarian ration of 300 gm., opened to-day (April 27) in the presence of the

writer, was found to be perfectly fresh and palatable, although put up five years ago; but more than half of the contents of the can consisted of water in which the meat had been cooked. The same quantity of nutriment could have been furnished without giving the soldier so much to carry. In Major Woodruff's ration the elimination of water is carried much further. The meat in a soup tablet is practically water-free. Fresh meat has twenty per cent of bone and other refuse. One pound gives, therefore, only four-fifths pound of edible substance; but three-fourths of this is non-essential water. In the pound there is, therefore, only one-fourth of four-fifths, equal one-fifth of dry nutrients. Hence, the four ounces of dried meat in the soup tablet represents about twenty ounces of fresh meat. Concentration in this tablet will probably be found to be associated with preservation to such a degree as to permit the sealed can to be replaced by some lighter means of protecting it from moisture. Time will be required to determine this.

The writer concludes with an expression of his regret at the meagerness of the details in this paper, and of his expectation that the Subsistence Department of the Army will have ample materials and experience before the next meeting of this Association to place the subject on a sound practical basis.

MEDICAL FIELD SERVICE.

By DALLAS BACHE,
Colonel, and Assistant Surgeon-General, U. S. Army.

Perhaps I should qualify the title of this paper somewhat, because I do not wish to speak so much of the entire organization and work of medical field service, or field hospital service—a lesser denomination—as to direct your thought to some matters, both of men and discipline, about which I think we are either mistaken, or light hearted and inattentive. The last annual Proceedings of this Association contain full and accurate accounts of the medical organization of all important foreign armies, and of our own halting recognition of its necessity. You will be struck by the nicety of detail for this specialized work among nations the best prepared for war; and war, it is sometimes necessary to remember, is the sincere purpose of and sole excuse for any armed preparation. I do not desire, however, as I have said, to verify the sufficiency of all these adjustments of men and material for ordinary and emergency service, adjustments differing for the most part in degree, but to signify a few matters apart for your reflection and interest.

No one can doubt that the proper care and treatment of the wounded in the next war between trained antagonists is a matter for the most careful present consideration, and the most serious and continued preparation. It is safe to say that no one of us, whatever his age, his special experience, or his training, can form an adequate mental picture of the difficulties of the next great battle-field, its areas of destruction, its withering reach of fire, and its tremendous medical needs. It has not been long since the conception of such a war under modern conditions, and of what may befall in the care of the wounded in such battles, forced from a most experienced journalist, a man accustomed to campaigns, a witness of Plevna, Mars-la-Tour, and Gravelotte, the deliberate opinion that

the immediate or prompt rescue of the wounded in such conflicts will not be possible, nor attempted, and a prediction that no General, "in his hunger for men," will consent to lose from each of his army corps the thousand rifles which his bearer companies might otherwise serve. Success and victory, so the argument goes, secure the best protection for the disabled.

Nor is this the only skilled opinion and foreboding that discourage what may be called our present academic ideas of "first aid to the injured." The Austrian Billroth and the Prussian Bardeleben concur in the conclusion that "in future it will be no longer possible to remove the wounded from the field during the battle by means of bearers, since every man of them would be shot down. * * * And the most that can be aimed at is that the wounded man of the future shall be attended to within twenty-four hours" (Billroth); and again, "that the whole system of carrying away the wounded on litters during the battle must be abandoned, for it is altogether impracticable" (Bardeleben). These are not uncertain words, and it must be remembered that they are not phantasms of theorists appalled by predictions of terror, but the settled convictions of men who have dealt personally, and under many conditions, with the campaigns of 1866, 1870, 1877-8, and had either seen or directed the best sanitary soldiers of Europe.

What, then, are these new battle features which control the decision of such veteran medical directors as Billroth and Bardeleben, and such a seasoned war correspondent as Forbes? Briefly, they may be said to be the extension of the zone of effective infantry fire from 600 to 1,800 yards, with the extension of its interior zone of greatest intensity from 200 to 600 yards; the greater destructive range of artillery fire, covering a field of two and a half miles from the muzzle, all of which can be searched with shrapnel and shell; the addition to the artillery of the rapid-fire gun; the unfamiliar smokeless powder, and the resort to high explosives. These are essentially the new conditions of battle—the improvements, so-called; for we are familiar with the numbers, and there is nothing new in the topography of such fields, nor in the address, the courage, or stubbornness of the fight.

There is some temptation in dealing with the division of this subject which concerns the percentage of wounded to be provided

for, and, therefore, the allotment of men and material for that purpose, to illustrate with the figures and tables of losses in the greater combats of this century; and with abundant qualifications these percentages must stand as guides until perhaps rudely displaced. Two of these abatements must be held in mind in all such reckoning for medical supply: First, that the percentage of casualty will vary greatly in various parts of the field, although the provision for medical service, based on a calculated mean, can not be easily shifted in action, and the strain thus equalized; and, second, that no computation for medical service of an army should be made on the basis of the probable or assumed maximum loss of a part, such as a division or a corps. There are abundant instances where the casualties of such a considerable force have reached and even exceeded twenty-five and thirty per cent, under circumstances when the loss the army engaged has footed probably not more than twelve or fifteen per cent.

The loss in an extended campaign or war may be comparatively small, the loss in a single battle very great, and in some parts of that field excessive. The killed and wounded of the Union Army during the War of the Rebellion was 13.6 per cent out of an enrolled force of 2,326,168, much of which was never actively in the field; the corresponding loss of the Germans during the Franco-Prussian War was 14.3 out of 797,950 men who entered France. The loss of the German and French forces for the two stubborn days of Gravelotte and Mars-la-Tour was about fourteen per cent, while that of the 3d Westphalian Regiment on the latter field was 37.5 per cent, the heaviest loss sustained by any German organization during that war. The loss of the Union Army at Gettysburg, the most destructive contest of modern history, was twenty-one per cent; that of the Second Corps thirty-two per cent, while the First Minnesota of that Corps lost eighty-two per cent. Hancock lost out of his division, at Fredericksburg, in the assault on Marye Heights, thirty-seven per cent of his command, about the same figures as the loss of the celebrated Light Brigade at Balaklava, which was 36.7 per cent.

It is perfectly apparent, therefore, from these figures, and many others that could be given, that we should not adopt as a provision for medical service any estimate of battle casualty below fifteen per

cent; and I am of the opinion that the basis for calculation should, under the new conditions cited, be advanced to twenty per cent. The proportion of wounded to killed, and it is the wounded that compel our preparations, is generally given at four to one. In the War of the Rebellion the exact proportion was 4.8 to one; but it varies greatly, as it necessarily must under the many conditions of fire, fluctuating between six and three to one. If we could accept the ratio of the Chilian Civil War of 1891, we should revise our accepted deductions, for the ordinary ratio was exactly reversed, being four killed to one wounded. The reason for considering these results is that the Männlicher rifle, with its small ball and flat trajectory, was in use; the reasons for questioning the accuracy of the figures are evident to those accustomed to exact statistics. It is unfortunate for our present purpose that no results which are entitled to careful analysis have yet been reported of the casualties in the engagements between the Japanese and Chinese forces. The losses given have been insignificant, and not illustrative of the premises of this paper. My own judgment is that the whole loss in battle will be increased, that there will be more killed, more wounded, but that the ratio between the two will not be seriously disturbed.

Now, what is the medical organization, exclusive of medical officers, designed and set apart to deal with this large, calculated aggregate of casualty. I believe that, without exception, in all armies pretending to such differentiated work, first aid to the injured, and their carriage to the collecting stations, is distinctly assigned to the company of regimental bearers. The number of these bearers varies greatly, from 2 to a company of 250 men in the German service, to 4 out of a company of 65 men in our own; a ratio to company strength of .8 of 1 per cent in the one case, and of 6 per cent in the other. A German regiment, 3,000 strong, would, therefore, have 24 such bearers, while one of our regiments of 520 enlisted strength, on their present footing, would have 32. The English regulations provide 2 bearers for each company, whose strength is somewhat greater than our own. These bearers, it is true, have been selected for aptitude, instructed in emergency aid, and we may presume are proficient; but, in a paramount sense, they are soldiers, armed, laboriously trained and disciplined for the very

conflict they are entering, not neutralized by the Geneva Convention; and yet when the fight is on they disappear from the line of battle, lay away their arms and, organizing at the collecting stations, become the first line of assistance from those points to the troops actually engaged. This is the proposed, authorized, or implied system; but whether in the category of fact or fiction, it is, in my judgment, a fundamental and mischievous error. It is wrong in principle, independently of the small or large percentage of withdrawal of rifles from the fire effective, and the greater wrong in proportion to this reduction, and the loose definition of its employment. It is illogical to perfect a tool for a special purpose and then divert it to another and remote use for which it was not intended, but for which another tool has been carefully prepared. It is perfectly safe to say that this primary provision can not be made to work satisfactorily in any sense, except, perhaps, in attack or defense of fortified or more or less fixed positions; that it is impracticable in the stress of an ordinary campaign; whether approximately adequate, as it appears in the English allotment, 480 bearers; inadequate as in the German, 240 to an army corps of 30,000 men; or is profuse, as in our loosely determined system, that is unreliable, unworkmanlike, and extremely likely to be evaded. With us, and probably elsewhere, there is sure to be opposition on the part of commanding officers—company and regimental—to releasing from their effective fronts any number of bearers, an unwillingness in proportion to the medical necessity for the bearers themselves; the details will be made from the less reliable men; and no such reservation as we enter for the prompt return of bearers to their companies, during or after an action, will be or is likely to be observed (Par. 1,575, A. R.) And there is yet another evil for which I see no remedy. It is easy to foretell that the casualties of a campaign, by sickness or in battle—for these bearers will be much exposed—will force rapid and extensive changes among them, with the result that many of this regimental force will be unskilled in their medical duties, and we shall have another uncertain quantity introduced into a work requiring the utmost stability of personnel and a high average training.

I do not wish to be understood as criticising adversely the scheme of company bearers, so far as this relates to the presence in each

company of men informed substantially in emergency aid, and able to handle the injured properly by fixed or improvised methods. Such men are useful in a garrison or an encampment, and are a valuable object lesson of principles of constant application; they are illustrative of a larger organization we need to remember, and they have been and will be effective in the lesser combats in which our Army is ordinarily engaged. They will be abundantly justified when a serious battle is over, if they can be spared, in assisting the Hospital Corps proper to bridge over the first exhausting twenty-four hours; but they should form no part of the medical field service, and should not be computed in any allowance of personnel.

If you will refer to the many tables and formula for medical-field organization, in which the bearer companies and division hospital personnel are sometimes medically intact, or homogenous, so to speak, and sometimes are a compound of medical force, and transport retaining other features, you will find that the percentage of such allowance to the strength of the Army or command fluctuates about three, sometimes reaching three and a half per cent. It is easy to satisfy yourselves on this point; for, starting with a calculated mean of sick or wounded, and bearing in mind for the latter their probable classification as to severity, and the distance which they must be carried by litter, travois, or wheeled transport, and later, their care in the field hospitals, you can determine approximately the number of men needed for all this. To this you must add the reserves, both of bearer companies and hospitals, and so complete the medical service of the front. The result will justify, particularly under the probability of an increased casualty, a computation for medical service in the field of four per cent of the recognized strength of command, and that is what I think this medical force should be. The constructive treatment of this subject by Major Harvard of the Army, a member of this Association, in his published work on "Field Sanitary Service," is an exact illustration of what I mean by this verification of existing or theoretical standards for the work under discussion. Our own regulation says that the privates of the Hospital Corps who "perform the duties of litter bearers, service with the ambulance, and at dressing and ambulance stations, should number at least two per cent of the aggregate strength of the command" (Par. 1,590, A. R.), which, if literally interpreted,

leaves the personnel of the field hospitals to be added, but has the manifest disadvantage of being indeterminate, open to varied construction, and of wanting the value of detail or demonstration.

I would like very much to lay before you at least the larger considerations that should govern in the constitution of bearer companies, of the division field hospitals, and their associated transport; questions of medical autonomy, of tentage, equipment, and supply; but these would burden such a paper as this, and be outside of its principal motive. I must, however, say one thing, and it is that we are so far without any provision of this sort, not of material, but of general scheme of arrangement and finished detail. Our ordinary service in military communities, with troops seldom exercised in large bodies, does not compel, perhaps does not admit, much imitation of war. Our usage has been largely framed on the administration of the post. The small and fragmentary dominate our military system unconsciously. And so it is that with abundant soldierly and professional interest, ample ability, the device, the supply, we have not yet consummated our own recorded experience, and the later demonstrations of other armies, in a working scheme of medical field service, so plain in detail, that if ordered into action to-morrow you and I alike would know how to proceed, and with what men and material we should fashion our work.

It may be well to delay here for a moment, in order to avoid a misconception that may arise from nomenclature, and for a clear understanding and separation of subjects closely related but not identical. I do not wish you to infer that we have no legally constituted hospital corps commensurate with our small peace establishment; but to assert that the present organization, created in 1886, to perform "all necessary hospital service, in garrison, camp, or field (including ambulance service) can not, without further effort and legislation, be fitted for the field. There is nothing but the phraseology of this act that shows any purpose or instinct for war. Under it were authorized 146 hospital stewards, ninety-five acting hospital stewards, and 598 privates, an aggregate seldom reached, owing to economy of appropriations. As may be readily seen from the great ratio of non-commissioned officers to privates, this organization is suited to a highly divisible administration, that of small detachments for post or garrison service. It is not divided into

companies, nor is such a division possible or desirable, nor does it seem in any way probable that the aggregate force had any calculated relation to the strength of our present Army if mobilized; and, in fact, if mobilization were ordered, it would be necessary to withdraw the garrisons from every post we have, or to provide other medical attendance for the troops remaining, as well as for the sick necessarily left in hospital, in order to release the Hospital Corps, and collect it in the field. The creation of the corps, to replace our former method of company details, was, of course, a most important and satisfactory step, the first necessary move to further definition, but the definition is still unfortunately lacking; the attempt to secure the authorization by law of hospital corps companies, in 1892, having failed in the closing hour of that Congressional session to secure the President's signature. The garment is pretentious, but it has been shrunk for the use of a less imposing figure than we wish.

As illustrative facts, when such occasions as the Sioux campaign of 1891, and the riots in Chicago of last Summer, have assembled any considerable force of the Hospital Corps, there has been no compact organization for this purpose; but members have been hastily drawn, by ones and twos, from widely distributed posts, and there has been the want of cohesion and aptitude inherent to the service conditions of our enforced military system. The men are more or less trained individuals, but not a disciplined body, and this in spite of intelligence and desire.

Let us assume, however, in order to advance the argument upon the field, that our gross estimate of four per cent of command having produced 1,200 non-commissioned officers and privates for the medical service of an army corps of 30,000 men, this force has been distributed, and has furnished the regimental detachments—for the company bearers we will consider no longer available—the designated number of bearer or ambulance companies, which vary from three to nine according to their strength, and the views held in different armies, and the personnel of the three division hospitals. What is the intelligent spirit in which this force should be educated and disciplined for its duties, and afterward brought upon the field of action, under conditions always momentous, but now with an added severity as yet happily unrealized? How far may we advance

this medical force with adequate gain, to succor the wounded, under a fire that may begin to load our ambulances at two and a half miles? Or shall we accept the weighty judgments already cited at the outset of this paper, and content with the preparation of the field hospitals, withhold other assistance until the battle has ceased or gone safely forward?

Various divisions have been made of the line of assistance between the troops actually engaged, not simply under fire, and the greater security and more permanent rest of the division hospital. Two stations at least are generally assumed, one at which the wounded are collected, and a second where, under protection, the primary dressing of wounds may be less hastily done. The service between the collecting station and the front is at present performed by the company or regimental bearers, and that from the collecting to the dressing station by the regular bearer or ambulance companies. It is generally directed that the ambulances shall not go forward of the dressing stations. There is no substantial agreement in the designation for these asylums, nor in the distance between each and the front engaged. The shorter distance a wounded man is carried by any method the better, but he can not be even temporarily placed where there is great risk of his being wounded again; and it is wiser not to dress his wounds at all, except to arrest hemorrhage, than to do so under a fire, and in a confusion that makes reliable work impossible. It does not appear that it will be generally safe to collect the wounded at a point of less distance than 800 to 1,000 yards from the firing line, and the risk of seriously crippling transport and animals will halt the dressing or ambulance station at a mile from the front. The field hospital will generally be pitched three or four miles to the rear of this assistance. Many unknown considerations must control or advise; some configuration of the ground offering cover, the presence or absence of water, the facilities of approach by roads, the ready shelter of buildings, may determine the selection of such depots of aid within the purpose of each, and outside of a narrow obedience to the bounds given. In fact, these stations represent degrees of safety, none being beyond the effective range of fire except the hospital.

I have gone slowly over this part of the ground, because I want you to realize what these distances and this work will mean to the

medical officers and their men. It is, or should be, perfectly plain, in advance of any experience, that to secure any useful aid under the struggling interests and selfishness of a battle, to get upon the ground in good order, to move to assigned positions, to work rapidly but without confusion and without hesitation in exposed places if thought necessary, is practically a demand for the highest possible discipline and control, equally for the officers as for the men. And it is here, in this control and in the related tactical management of our medical field force that we have, in my judgment, the solution of any exigency of the battle with which we are concerned. The fire may be so destructive that it would be a useless sacrifice to send bearers forward. The medical officer in command must judge of this, and act accordingly; he may seek shelter or withdraw, waiting an opportunity for renewal of work; so, also, in their assigned duties with the wheeled transport, and even with the less mobile hospitals. It will be an unhappy time if this necessity for control is not held in constant view, and the discipline attained by careful training and example. It may seldom be possible, as is predicted, to do our work of assistance at large as we wish, but there will be places and occasions, and we can be ready and choose. If we must wait altogether, then let us wait like soldiers, in a place of selection, in order, and ready for an advantage. We are told of many substitutes for this disciplined training, of willingness and courage, of professional zeal and ingenuity, of some chance aptitude, and we may be told that it is not necessary at all. There is a disposition, not unkind but not discriminating, among officers, alike in my own corps and in the line, to be amused at the technical drill of our small detachments, the increase of ceremony, and the assumption among medical officers of the military title of their rank. These things are, according to my conception of our work, as much and as purely parts of a military necessity as the patient preparation of any troops, the subordination of officers, the authority of title, and the cultivation of the habits and spirit of a soldier. More than this, they are not simply necessary, but imperative; and they can no more be neglected or improvised for our ultimate value in war than such military attributes and forces can be omitted from the training of a troop, company, or battery in time of peace, and then applied by magic. What we sow now in ease, neglect, or defi-

ciency of preparation, we will reap some day of urgency in delays, confusions, and irreparable loss.

I can not do better in this closing than to address you in the earnest words of an experienced officer of the English medical staff. As you know, the English medical officer, as well as his civil brother, has opposed to him a class prejudice of which we know nothing. There are, therefore, some vibrations in his voice unfamiliar to us; but it is the strength and truth of the appeal that we recognize. He is speaking hopefully of a day when his own medical service will be more fully organized, and his own medical corps coherent:

That day is coming, and, let us hope, rapidly; but it can only come when the Medical Service itself fully appreciates its rôle and remembers that, however attractive and charming may be the life of the civil physician, who enters the home of his patient and simply orders a treatment to be carried out by affectionate relatives, the duties and the life-work of the soldier-surgeon must be completely and entirely different. Not only must he order treatment, but he must see to his order being carried out in distant stations; not only must he prescribe drugs, but he must see the drugs are there on the battle-field; not only must he direct food to be given, but he must see that the food is forthcoming—even in the desert; not only must he instruct the orderly, but he must see that the orderly obeys him as a soldier. All this differentiates him largely from the civil physician, working in peace, trained, it may be, in the same medical college. The lives of the two men are absolutely divergent, and the common title of "Doctor," given to each, is wholly misleading in the case of the military officer. Not all the surgical knowledge of a Brodie or a Ferguson will take the convoy of 200 wounded soldiers from Kabul over the snowy Pass of Lataband for 200 miles to Peshawar. Not all the medical science of a Jenner or a Watson will insure that in the great base hospitals of war every one of the hundreds of patients is seen and carefully attended to, cleansed, fed, and cared for on a hostile shore, and shipped for England in all the confusion and turmoil, and, oftentimes, the selfishness of the base of an army in the field. My dear civil brother physician, it is true I was at the same school of medicine with you; yes, but it never taught me to work in the Soudan square and see that others worked under me, until every man that fell was not only dressed, but fed and cared for, and carried for miles off the field to a far-away tent hospital. In the crowded war transport, in the Indian camp, in the torrid heats of Suakim deserts, or in the steaming tropical depths of Malayan forests, I do other soldier's work for England than you who serve her in a civil capacity at home, and I do it far away and alone, often unaided, and far from sympathetic help. Energy, courage, self-sacrifice, devotion to duty, a soldier's heart, discipline to the yielding up one's life under fire—all these are needed. Life with the soldier on the choking march in the burning Soudan, in the drifting snow and freezing winds of Kabul table-lands, the burning tents in the wide, bare, Indian plain—

all these things shared with the soldier separate me far from you with whom I learned the physician's art. It is true I am a doctor in the civil sense, and glory in the fact, but I am a soldier of England, too, and for her and her people I have given all the devotion and all the self-sacrifice she demands of her soldier-sons, and although every man in the army denied me the title of soldier—from the chief at the head to the last recruit that joined yesterday—I reply you are wrong, and you are wrong because you do not know and you do not understand; and I appeal from the army in its prejudice to England and her people to do justice between us, and to say if she denies me the title I have so justly and, I hope, so devotedly earned in her cause; for the army does not belong to the army but to the nation that lies behind it.

This extract is from the published "Notes on the Organization and Working of the Indian Field Hospital in War," by Brigade Surgeon Lieut.-Col. Evatt, an active and resolute officer, whose work in these notes and in others relating to medical organization I can commend to your reading. The whole argument is an almost passionate appeal, from an officer who has lived under a more systematized medical field service than our own, for a more precise military treatment of this subject, and for the distinct military significance of the medical officer. He has my most cordial affiliated support, for I am convinced that it is in the exact training, soldierly and technical, which we can gain now in our isolated posts, or Summer encampments, we shall be best fitted for the increased stress of war.

Let me mark, distinctly, in recapitulation, the places where we must build or improve before we can be said to have a medical field service that, although never assembled on a battle-field, is thoughtfully fitted for use, and something more than a dramatic theory. We need, first, to expand the treatment of this whole subject, as now given in our regulations, and to define the personnel and material for each purpose, so that the allowance, procedure, and responsibility shall be beyond conjecture or question. In this treatment I think the company bearers should be eliminated as a part of the medical field force, remaining auxiliary for some restricted uses only; and, in my judgment, the calculated increase of work on the battle-field, as well as the withdrawal of the company bearers, should be accounted in the moderate increase of the Hospital Corps indicated, however that may be divided for service. The divisions will easily suggest themselves, and the necessary classification of the enlisted men could then be settled. But to make any provisions effective, we need, second, the highest type of the medical soldier.

MEASURES FOR THE PREVENTION AND SUPPRESSION OF DANGEROUS CONTAGIOUS DISEASES IN GARRISON AND IN THE FIELD.

By Lieut. H. Lincoln Chase,
Assistant Surgeon, Massachusetts Volunteer Militia.

Thus far the time of our Association, in its four previous annual meetings, has been mainly occupied, and very well occupied, with consideration of military surgery and the problems of transportation of the sick and wounded. The important subject of infectious and contagious diseases has yet to be considered. Therefore, when invited to prepare a paper or present some topic for discussion, it seemed proper to bring before the Association the subject of this paper, namely, "Some Measures for the Prevention and Suppression of Contagious Diseases in Garrison and in the Field."

My connection with a Board of Health, and some service in the contagious wards of the Boston City Hospital and elsewhere, make me feel an active interest in this subject, and I hope to hear it fully discussed.

The soldier wounded on the field of battle, or anywhere else, is now quite sure of receiving prompt and appropriate first aid, and speedy and comfortable transportation to the field hospital. The soldier disabled by disease is the one oftenest met, most apt, also, to be overlooked and, consequently, as most of us know, the mortality from disease is considerably higher than that from wounds. Col. Woodhull, of the U. S. Army, says: "In the Mexican War, of the regular force, 73 officers and 862 men—total 935—were killed or died of wounds; and 85 officers and 4,629 men—total 4,714—died of disease in the field, or rather less than 1 to 5. Of the volunteers, 1,549 officers and men died by violence, and 10,986 by disease, or a little less than 1 to 7. During the Rebellion 99,183 died from the casualties of battle, and 171,806 from disease, or nearly 1 to 2; while for colored troops it was 3,417 by violence, and 29,963 by disease, or 1 to 8.7.

The German Army, in the war of 1870-71, is the only one known to have kept its mortality from disease below that from battle. This

probably was due to the shortness of the war, the rapid succession of battles, the trained troops and, presumably, also to exact discipline insisted on in the care of the men.

According to "La Médécine Moderné," the Official Gazette of Japan reports that from July 16 to December 6, 1894, the Japanese Army lost, in killed and wounded together, about 350 men, and by disease 450 men, showing that at the present time, as in the past, disease is the principal danger the soldier has to face. It follows, then, that the prevention and suppression of preventable disease is one of the most important duties of military medical officers, both in peace and in war. In a certain sense, of course, all diseases are, theoretically, more or less preventable, but I propose to limit myself to brief consideration of some of the more common and more dangerous communicable diseases met with in troops in this country in peace and in war.

This table gives some idea of the prevalence of contagious and infectious diseases among the white troops of the Union Army during the four years of the War of the Rebellion, and the fourteen months following its close. Fortunately, Asiatic cholera made no visit to the United States during the war.

SICKNESS AND DEATHS OF WHITE TROOPS OF U. S. ARMY FROM TEN CONTAGIOUS OR INFECTIOUS DISEASES, FROM MAY 1, 1861, TO JULY 1, 1866.

From Medical and Surgical History of War of the Rebellion

	Cases.	Deaths
Typhoid fever,	75,368	27,056
Yellow fever,	1,181	409
Consumption,	13,499	5,286
Small-pox,	12,236	4,717
Measles,	67,763	4,246
Typhus fever,	2,501	850
Diphtheria,	7,277	716
Scarlet fever,	578	70
Syphilis,	73,382	123
Gonorrhea,	95,833	6
Total,	349,618	43,579
Orchitis,	13,564	7
Stricture,	2,438	7
Purulent ophthalmia,	4,918	2
Total,	370,538	43,595

In the application of preventive measures, for one and all of the diseases we are now considering, we should begin with recruiting. As recruiting is now done in the Army and Navy there is little to criticise, and much to commend. Systematic examination of recruits in the National Guard and Volunteer Militia, unfortunately, is not at present extensively in vogue, though a beginning has been made in a few States—among them Massachusetts; the annual tour of hard camp duty, however, results in weeding out many of the physically or morally unfit. As very young men have great susceptibility to disease, especially to communicable disease, not to mention other reasons, twenty years, with few exceptions, should be the minimum. It is a fact, however, that boys of sixteen to eighteen years of age are accepted by the U. S. Army. Of course, misrepresentation as to age by recruits is to be expected.

During the War of the Rebellion the minimum age was raised to eighteen in the regular Army, the maximum still remaining at thirty-five. Under the Enrollment Act, however, the ages were fixed between twenty and forty. The minimum in our service was again modified April 23, 1874, and became sixteen. Our present regulations in the Army prescribe as the minimum and maximum sixteen and thirty-five, respectively, though the age below eighteen is limited to musicians, and between eighteen and twenty-one to those who obtain consent of parents or guardians, The first Napoleon said: "I must have grown men—boys serve only to fill the hospitals." General Roberts, in his great march from Cabul to Candahar in 1886, found it was the young soldiers who succumbed to disease, while the old became stronger every day. Lord Raglan, the Commander-in-Chief in the Crimea, found the recruits sent him so young and unformed that they fell victims to disease and were swept away like flies." The Duke of Cambridge and Viscount Hardinge give like testimony. The annual report of the Surgeon-General of the Army for 1881 showed such a marked increase of sickness, and he says "the rate was so much above the mean for the whole army, that he questioned whether the services rendered by these young men were equal to the cost of their maintenance."

It seems the general opinion that before a recruit has acquired the physical and moral qualities to enable him to execute the duties incident to military life he must have reached a certain age. This

should not be under eighteen when the training of the recruit is to begin, and never below twenty as a soldier in the ranks. Young recruits from the cities are preferred to those from the country, unless a year's training can be given, as country boys are much more apt to acquire such diseases as measles, mumps, and whooping cough. For immediate and hard service, Woodhull says: "When possible, take town-bred men. If a year or two can be had in which to train them and get them over measles and mumps, take country-bred men."

When a recruit has been accepted by the Army he is vaccinated, thus securing the protection necessary against small-pox. His protection against the other diseases in our list is not so easily secured. While in garrison he will probably be protected from such infectious diseases as are contracted from impure water, milk, and food, notably typhoid fever, quite as well as civilians are protected. As in civil life, the water supply must at all times be kept absolutely pure. In garrisons, where sewers are not used, the contents of water closets must be properly attended to. Should the drinking water be not above suspicion, when typhoid or cholera are about, it should be filtered, or boiled briskly for at least fifteen minutes.

In the field, typhoid, cholera, and other diseases that spread by pollution of the drinking water by discharges from the bowels, have to be carefully guarded against by avoiding old camp grounds, if possible, and by certain other measures. Quoting Woodhull again: "The first duties when a halt for the day is made are to designate a place to attend to calls of nature, to post sentinels over the water supply, and at once to dig sinks. The only exception to digging these is when the command is very small, is certain to march the next day, and none will follow. Sinks should be so placed as not to be in the course of the prevailing winds to camp, and so that they can not pollute the water supply, either directly or by soakage. The most useful field sink is a trench two feet wide at the top, from three to ten feet deep, and from twelve to fifteen feet long. Sinks should be multiplied, rather than individual ones made too long. The earth should be thrown to the rear, and a layer of a few inches from it covered in every morning, or oftener if necessary. All sinks should be covered in and marked on breaking camp. Sinks should be screened by bushes. In temporary camps a pole serves

as seat; in permanent, box seats open to the rear may be placed. Urinals may be placed near the camp, and in permanent camps it is important to have them of easy access."

Of course, it is well to disinfect the bowel discharges in sinks in all cases, if practicable; but discharges from cholera or typhoid patients, or suspects, invariably. Either milk of lime, copperas, or, best of all, corrosive sublimate should be used for every discharge. In case of danger from cholera, acidulated drinks, *e. g.*, lemonade of aromatic sulphuric acid may be freely used. It seems probable that Hafkine's preventive measure against cholera in India, namely, injecting with an immunizing fluid soldiers believed to be exposed, will after a time be perfected. Typhoid fever caused 27,000 deaths in over 75,000 cases in white troops during the war.

Though there was, fortunately, no visit of Asiatic cholera to this country during the progress of the war, in the last six months of 1866 there were 1,759 cases and 709 deaths from that disease among the white troops; their mean strength, in the infected garrisons, being 9,083. Among the colored troops, with a mean strength of 3,697, in the infected garrisons, there were 911 cases and 508 deaths. The first case reported occurred in New York Harbor, July 3, 1866. Among the victims were five medical officers, who were stricken down in the active performance of their duties in the epidemic.

Yellow fever is, for the most part, a disease of navigable regions in hot and moist climates and, as a rule, attacks the same person but once. Usually, if not invariably, imported, its foci of greatest virulence are coincident with centers of filth, which fact suggests one very important preventive measure, namely, extreme cleanliness as to animal filth. Exclusion of infected material, and early removal of troops to a camp in a dry and elevated rural district, there to remain until frost comes, are the most important preventive measures. Other precautions are temperate habits, freedom from all depressing influences, avoidance of all filthy localities, and of the night air. Quarantine, as such, is a needless annoyance.

It is now thirteen years since the infectious nature of tuberculosis was put beyond question. From the days of the English Barrack Commission crowded sleeping apartments and indoor life were believed the most important factors in the spread of the disease, and, of course, if the bacteria of tuberculosis are allowed to get into

the air the conditions mentioned must remain as dangerous as before. Though this disease, in civil life, is more dangerous than any other, and usually selects as its victims persons at a period of life when their value to the State is the highest, little was done by sanitary officers for its suppression till within a very few years. A few of the best informed physicians have enjoined care in the disposal of the sputa, and have had circulars of instruction printed for the use of consumptives and those exposed by them — notably a society in Pennsylvania, and Dr. De Lancy Rochester, of Buffalo — a preventive measure later adopted by the Massachusetts and some other State Boards of Health.

The early detection of the disease, by the bacteriological test, in persons suffering from cough and expectoration, the proper disposal of sputa, and the tuberculin test for all milk cattle, which last measure is now enforced in Massachusetts, through the efforts and under the supervision of Dr. Frederick Osgood,* Chairman of the State Cattle Commission, are among the most useful preventive measures. (See table.)

Of the exanthemata, measles is a particularly serious camp disease, always to be anticipated in newly raised commands, especially those from rural districts. There is no way known at present of preventing the disease, if exposed to it and not previously a subject of it. Therefore, special hospital accommodations must be arranged for all newly raised troops. (See table.) The colored troops had 8,555 cases and 933 deaths.

Small-pox is practically unknown at present in the German Army, and also in our own Army, this immunity being secured by vaccination on enlistment. (See table.)

Typhus fever, long known as camp fever, ship fever, hospital fever, now a rare disease, seems only to occur where there is overcrowding and lack of cleanliness. There is no other disease that claims so many victims from the medical profession during an epidemic. In threatened epidemics of typhus, when climate permits, experience has shown that troops are best off, whether well or sick, when quartered in tents. (See table.)

Diphtheria is often met with in troops, occasionally even in the camps of instruction of the militia. Now that the bacteriological

*Dr. Osgood is also one of the two veterinary officers of the M. V. M.

test is so easily available almost everywhere, diphtheritic throats will be detected earlier than formerly; the first cases will be promptly isolated in tents or small hospitals and cured with antitoxin. All susceptible persons exposed will be treated with the same, and the threatened epidemic will be suppressed.

The appalling amount of venereal disease that exists in armies is well shown in the table. Something might be done to mitigate this evil by private medical instruction of recruits, which I understand is now systematically done to some extent and with fair success abroad, and by providing, in fixed camps or posts, the constant healthful occupation and amusement which are essential to health, good morals, and general efficiency. Dr. Pilcher, of the Army, has shown us that healthful sports always tend to increase resistance to disease, elevate morals, and make less attractive the disreputable amusements in which soldiers are strongly tempted to indulge.

In the field, and especially during active maneuvers or actual warfare, disease and intemperance are naturally much less prevalent. This was very noticeable in Sherman's famous march to the sea; and, as a general rule, marching troops remain the healthy troops.

Finally, after most of the diseases in our list, including consumption, effective disinfection of infected barracks, hospitals, tents, and clothing is absolutely necessary. Barracks should be disinfected by washing the floor and walls, and other surfaces, with a 1-1000 solution of corrosive sublimate. Sulphur fumigation, so much used in the past, is not to be relied on. Behring, in his latest writings on disinfection, mentions sulphur only in connection with disinfection of holds of ships, and there mentions it only to condemn it. Tents, blankets, clothing, etc., are best disinfected by steam, under pressure if available, otherwise by the best means at hand.

In closing, I wish to acknowledge my indebtedness to the works of Drs. Billings, Woodhull, and other medical officers of the Army, and not least among these works the valuable contributions to science of the distinguished President of our Association, Surg-Gen. Sternberg.

INSTRUCTION OF THE HOSPITAL CORPS OF THE U. S. ARMY.

By H. S. TURRILL, Major and Surgeon, U. S. Army.

By Act of Congress, approved March 1, 1887, and published in orders April 11, 1887, was organized the Hospital Corps of the U. S. Army. Previous to this act hospital stewards of the "first," "second," and "third" classes, with soldiers detailed from the ranks as hospital attendants, constituted the working force of the Hospital Department of the Army. The steward of the "first" class received his appointment from the Secretary of War, and was really the only distinctive and permanent hospital man in the corps. Stewards of the "second" and "third" classes were detailed for the duties by the commanding officer of the post. When there were more than four companies a steward of the "second" class, and with four companies or less a "third" class steward was detailed. The force of attendants was drawn by detail from the troops at the station, and were as good, indifferent, or bad as the constant skirmish between the medical officer and company commanders would allow. The medical officer trying for good men, the company commander in many instances trying to avoid the detail altogether, or, failing in that, detailing his most worthless men. With the organization of the Hospital Corps, under order of the Adjutant-General of the U. S. Army, dated August 11, 1887, many of the men then detailed as cooks, nurses, and attendants in the hospitals were transferred to the Hospital Corps, and began their work as privates of the Hospital Corps, with a reduction of pay; for, when detailed as cook or nurse, they were entitled to extra duty, which pay was cut off from privates of the Hospital Corps. This fact somewhat restricted the selection of the transfers, as good men hesitated to accept the place of greater requirements and duties for less pay.

The order organizing the Hospital Corps provided for a course of instruction by the senior medical officer, consisting of lectures and demonstrations in the methods of rendering first-aid to sick and wounded, and of drills in the ambulance service, and also as litter-bearers, in accordance with a prescribed manual. A manual of drill was promulgated and, after being several times revised, was issued, and became the text for instruction in the Hospital Corps. At its organization it was provided that no men should be transferred to the Hospital Corps who had been in the service in the line less than one year, and that men enlisting for the Hospital Corps should be attached for one year to companies of the line stationed at Ft. Monroe, Ft. Leavenworth, and Ft. Riley for military training and instruction. But few, if any men, were so attached, and the training of the privates of the Hospital Corps was carried forward at their posts of duty with more or less regularity according to the leisure or disposition of the surgeon in charge. At Ft. Riley much more attention was paid to instruction and drill of the Hospital Corps than at some of the other posts, and there was formed the nucleus of instruction which resulted in the formation of the two Companies of Instruction of the Hospital Corps, as they now exist, at Ft. Riley and Washington Barracks.

On July 29, 1891, the Surgeon-General of the Army, in a letter, asked authority to establish three Companies of Instruction for the Hospital Corps, at the several posts of Ft. Riley, Kansas, Ft. D. A. Russell, Wyoming, and Ft. Keogh, Montana. This was approved by the Major-General commanding the Army, August 7, 1891, and steps were at once taken to organize the company at Ft. Riley. On October 20, 1891, twenty-three privates of the Hospital Corps had been assembled at the post, and the work of instruction begun by Major John Van R. Hoff, Surgeon, U. S. Army. The company at Ft. D. A. Russell, Wyoming, was organized a little later, and continued its work until transferred to Washington Barracks, District of Columbia, where it is now stationed. The company at Ft. Keogh, Montana, was not organized. The two companies have continued the work from their organization until the present time. The Ft. Riley company has received 159 privates for instruction, twenty have been discharged for various causes, and 107 have passed through the course of instruction and been sent to posts of duty throughout

the Army. There are now remaining at the school thirty-two privates, eleven of whom are trained and ready for stations. The course of instruction and drill has been as follows, viz.: Setting-up drill, first aid, anatomy and physiology, nursing, pharmacy, and bandaging, with, later, instruction in cooking, dispensing, ward-work, papers and records, the use of tools, ambulance driving with the care of animals, the care and use of instruments, and, finally, a course in mounted drill and the care of horses. The order of exercises has varied somewhat, but has been about as follows: Setting-up drill and drill with arms, 9.15 to 10.00 A. M., five days in the week as long as required; study from 10.00 to 11.00 A. M., five days in the week; lecture on instruments, Mondays, from 11.00 to 12.00 M.; lecture and recitation on nursing, Tuesdays, Wednesdays, and Thursdays, from 11.00 to 12.00 M.; first-aid drill, five days in the week, from 1.30 to 2.30 P. M.; lecture and recitation on anatomy and first aid, five days in the week, from 2.45 to 3.25 P. M.; instruction on bandaging, five days in the week, 3.45 to 4.30 P. M.

The setting-up drill with arms (the carbine and revolver) is carried on just as long as it is required to make a well set-up soldier, and it is found that this part of the drill is much more quickly acquired by the men with arms in their hands than with a stick, or without anything. The knowledge of possessing the power of defense gives a hundred-fold more confidence to a man and makes a hundred-fold more of a man of him; and, until the Articles of the Geneva Convention are adopted and lived up to by Indians and rioters, the knowledge and power to defend himself and his patient is eminently essential to the education of the Hospital Corps soldier. The lecture on instruments, one hour a week, is given by one of the surgeons, and is continued until each man has a complete knowledge of all instruments, their uses, the necessary care of them, and all the duties of a Hospital Corps private in handling, cleaning, and preparing them for the use of the surgeon in the hospital and in the field. The instruction in nursing, in the form of recitation, one hour three days in the week, by the senior steward of the company, has been a general instruction in ward-work and care of the sick and wounded. Recitations and instruction in pharmacy, one hour a week, are of a general character, reserving, for a later period, a more complete course in this as well as the preceding branch in the ward and dis-

pensary. The lectures on first aid and anatomy were, for a time, given at different hours, but it was found that the knowledge was more quickly and thoroughly acquired when given together. These lectures are given one hour a day, five days in the week, by one of the surgeons, and every wound, injury, or condition of sickness that may occur on the battle-field or in garrison is thoroughly explained until the men are thoroughly familiar with the disability; the anatomy of all the parts and the relation of all the parts to the injury, their appearance in health, and probable appearance in disease, and the proper first-aid treatment. This work is gone over and over until every man is thoroughly acquainted with every possible injury and disease, and can at once diagnose the injury and know the proper first-aid treatment, and can, with a reasonable degree of skill, apply any and all treatments for the injury. The first-aid drill of five hours a week is an assembling of all the course of instruction at the school; for a short time the company is drilled in the manual of the litter, and then a number of men are thrown out to act as patients, a surgeon affixing the diagnosis card, and the litter-squads taking the patients, and giving such first-aid service as the case requires. In this part of the drill the conditions are considered the same as those of the battle-field; the bearers are instructed to work as if under fire, giving all security that is possible to their patients from the enemy's fire, by taking advantage of all cover that the ground presents, and then to remove them by the litter, or by the various positions of carrying by one or two bearers to the ambulance station, always taking advantage of all cover that can be had. Each and every condition of wound or injury that can occur is thus gone over and over, till all are expert in recognizing and caring for, in the proper manner, any and all injuries that the battle-field can present. From 3.45 to 4.30 P. M., five days in the week, instruction in bandaging is given under charge of the steward, and all are required to put on any and all of the different bandages, and are kept at work thus until they have become expert bandagers; they are taught all the different forms of bandaging, and the adaptability of the different forms to particular forms of injury. This course of instruction continues until a very great degree of proficiency is reached in every case, and usually requires four months of instruction, scarcely ever less, but often much more, according to the individual ability and intelligence of the man.

This constitutes the ground work of instruction of the Hospital Corps, and at its termination the general aptitude of the man for further instruction has become pretty well known. For the completion of their course, to all are given instruction in cooking, to such an extent as to enable them to prepare the field ration for themselves and the patients; to ride and care for horses, and the duties of a mounted man. They are then taken into the wards of the hospital, and under the surgeon, steward and ward-master given one month's ward-work, and are then rated as qualified men for assignment to station as ordinary instructed Hospital Corps privates. From this class are now taken such men as have shown an aptitude for further instruction as pharmacists, cooks, ambulance drivers, and for training in the use of tools. For instruction in dispensing and in the duties of clerks, four men are taken from the company and placed in the dispensaries of the post, of which there are at this place two completely equipped dispensaries and offices, under the immediate charge of two thoroughly qualified stewards, and here the men are given a thorough course in compounding and dispensing medicines, practical as well as theoretical. In the office they are required to make out all papers pertaining to the Medical Department, to acquire a reasonable degree of proficiency in the use of the type writer, and to become generally proficient in all clerical and dispensary work. A very fair degree of proficiency usually requires four months of instruction, so that for those selected for this instruction the course at the school is continued for eight months instead of six, the time considered sufficient for the general course of instruction. For instruction in cooking, from such men as have shown an aptitude for, and a desire to learn that branch of hospital work, three or four men are selected and placed in the two kitchens, under the charge of the two cooks, who are thoroughly trained in this work, and are required to assist the cooks in the preparation of the food for the hospital and the company; and, in addition, from funds appropriated for that purpose, materials are purchased, and they are required to prepare all articles of diet, the materials for which can be obtained in the vicinity. This instruction is under the immediate supervision of the surgeon in charge; the recipes are explained and the results carefully inspected by him. The course of instruction is continued until a proficient and well-qualified cook is pro-

duced. Four months is the usual time required for proficiency in this branch. For instruction in ambulance driving a man is selected who has had experience in the use and care of animals, and placed under the charge of the ambulance driver and given the work of driving the ambulance, first with two and then with four animals; at first around the smooth roads of the post, and then over the rough and difficult country of the surrounding reservation, until the driver is capable of taking a four-in-hand ambulance over any and all country where an ambulance can go. One or two men who have had some experience in use of tools, are placed in the carpenter shop attached to the hospital, and there required to attend to all the various matters of repairs to litters, and the almost constant breakage of wooden material that occurs about the hospital and company. Among the property at the school is the canvas and all the fittings for a complete field hospital; during their course all the men are frequently drilled in the erection and fitting up of a complete field hospital. During the season for target practice a complete field hospital is established in the target camp, and detachments of the Hospital Corps are given practice work for a tour of one month each in the duties of such a hospital. At Ft. Riley is located the School of Application for the Cavalry and Light Artillery of the United States Army, and at the completion of its course, during October and November of each year, occur the field maneuvers, which consist of all the various movements of attack and defense of two brigades of mounted troops. The surface of the reservation at this place — a very large one, about 30,000 acres — is exceedingly diversified, and affords all kinds of country, from a beautiful plain of three or four square miles to an extremely rough and broken country, much cut up with wooded ravines, with difficult fords of the Kansas River, a stream of considerable size. Over this country all the problems of attack and defense are carried out with all conditions as near actual combat as possible. With all these combined maneuvers, the Company of Instruction of the Hospital Corps takes its appropriate place and part. The percentage of loss of the opposing forces, as declared by the umpires, are required to drop out at the point of injury, and the Hospital Corps is required to carry out its battle-field work; dressing and removing the wounded during the action, and carrying out the first-aid field work as far as the dressing

station. This part of the work is the most instructive of the year, as all conditions are made as nearly those of the real fight as possible, and are entered into with great earnestness by those engaged; and, as failures and mistakes are noted and criticised by the umpires, all in their several departments strive for success to their utmost. This part of the year's instruction is most appreciated by the men and officers, as experience in their various battle-field duties is thus acquired that could not be gained under any other conditions, save that of actual conflict.

This course of drill and instruction has been carried on since the formation of the Company of Instruction of the Hospital Corps. Of the practical results of this course of training very little can be seen at the school, for as soon as the men are instructed they are sent for duty to the various stations of the Army; but from such chances of service in accidents as this large mounted command has afforded, the well-trained men have invariably acted in a prompt and efficient manner. From a long experience in military surgery, which extends from the battle-fields of the Civil War and through many Indian encounters, I can unhesitatingly say that with a body of Hospital Corps men, trained as it is our endeavor to train them at the Hospital Schools of Instruction of the Army, can be reduced the suffering and dangers from wounds and accidents of the battle-field to a great degree, as well as saving to the fighting force of the Army a very large per cent of the force which, under the old conditions of service, was necessarily lost.

HOSPITAL CORPS INSTRUCTION AT MILITARY POSTS.

By CAPT. W. C. BORDEN, Medical Department, U. S. Army.

The Regulations of the United States Army require that all available men of the Hospital Corps shall be instructed for at least four hours in each month in the duties of litter-bearers, and the methods of rendering first aid to the sick and wounded. In addition to these required hours of instruction, the Regulations state that the Hospital Corps will be instructed by the senior medical officer of the post at such times additional as he may deem necessary, and that this instruction shall consist of lectures and demonstrations in methods of rendering first aid to the sick and wounded, and of drills in ambulance service, and as litter-bearers, in accordance with the prescribed manual.

These brief directions, mandatory as to four hours' instruction each month, and general as to the manner of employing these and the permitted extra hours, are all the directions given to the medical officers of the Army for the instruction of the enlisted men of the Hospital Corps. The Regulations state that the instruction shall be in first aid, in drills in ambulance service, and as litter-bearers. No mention is made of instruction in the other and more necessary duties which are required of the members of the Corps; no rules are laid down, and each medical officer commanding a detachment is a law unto himself as to how and how much he shall instruct in each of the prescribed subjects. The consequence is that the practice varies with the man. The military enthusiast drills his men not only the required four hours, but many more, until they can handle litters and render theoretical first aid with the precision of automatons.

The medical enthusiast instructs his men in the minimum of drill, the medium of first aid, and, availing himself of the allowed extra hours, gives them the maximum of instruction in nursing in the

many aspects it presents in military service. The man without enthusiasm, either military or medical, supervises the drill and instructions, and both are carried out at a minimum. In this way, with varying quality and quantity and with equally varying results, the requirements of the Regulations, but not the needs of the service, are fulfilled.

It is obvious that efficiency can not be reached through such differing ways. To attain efficiency there must be method. The method must be founded upon the needs of the service, and must be followed by all who instruct. Now, the needs of the service are neither exclusively military nor exclusively medical. They combine both, but are primarily medical and secondarily military, and to meet them the members of the Hospital Corps must have a knowledge of the following duties and be able to perform these duties in an efficient manner: The nursing and care of sick in hospital; assisting medical officers at operations; carrying the sick or injured; litter, ambulance, etc.; military duties; marchings, inspections, etc.; first aid.

Nursing is placed first, for it is for the care of the sick and injured and the preservation of the health of the Army that the Medical Department exists. Men are frequently instantly killed; they are seldom instantly cured. For every case of first-aid there will be thousands of days of nursing, and for every man carried back from the fighting line there will be hundreds cared for in hospital.

To nurse intelligently and properly a certain amount of knowledge of anatomy, physiology, and hygiene is required, together with an understanding of the many duties which belong to nursing alone. After nursing, and closely connected with it, is the assisting of medical officers at operations. In military service the services of nurses at operations are always required, and often through lack of professional surgical assistance they, or the hospital stewards, have to render the assistance usually given by assisting surgeons. Therefore, the members of the corps should have a knowledge of how to prepare patients for operations, should know the care of instruments, the application of dressings, and the principles of aseptic and antiseptic surgery. Closely related to the duty of nursing is the transportation of the sick aud wounded, and a knowledge of how to handle the injured and sick is particularly necessary in

military service. The exigencies of battle and campaign require the frequent movement of the injured, and the privates of the Hospital Corps should know how to lift and transport the sick and wounded with facility, dispatch, and with a minimum of discomfort and risk. It is for this end, and for this end only, that the litter and ambulance drill exists.

In actual war the numerous commands of the drill manual will probably seldom be heard; but, if four, three, or two men with a litter can get to wounded man; can, with or without command, place themselves, lift him properly to a litter, and then carry him to dressing station or ambulance, the necessities of the occasion will be met. I do not intend to decry the method of drill as now adopted and used. The drill is a good one, but it is a means, not an end, and the end should always be kept in view. The establishment of the Hospital Corps and the adoption of a drill manual brought military methods and drill into prominence. It is obvious that military method is necessary in all matters pertaining to military organization. Without it the Medical Department, which is one of the necessary impedimenta of an army, could not be properly co-ordinated with it. An army requiring neither food nor clothing, never in danger of illness, without sick, and with none of its individuals ever wounded would be nearly an ideal fighting force, and would need no departments other than those of administration and justice. But as such an ideal is impossible, the departments of Subsistence and Sanitation must be connected with the army in such a manner as will least impede it and will render it most fit for combat. This can only be done by methods of military discipline and command, and the Hospital Corps should be so instructed that it, and its individual members, will forward and not impede the military machine. But, while necessary, the importance of military method and drill, compared with other duties required of the Hospital Corps, should not be overestimated. They should receive their proper share, and their proper share only, of attention, both in instruction and practice. Finally, instruction in first-aid is necessary—necessary not so much for the practice of first-aid alone as for the reason that a knowledge of it makes the possessor more valuable in other ways, and enables him to perform other duties more intelligently than he otherwise could.

In itself, first aid is the least important of all the duties required of the Hospital Corps—least, for the reason that it will be least frequently required or properly performed. With the allowed strength of the Hospital Corps reduced, as it will be by ineffectives from casualty, sickness, and vacancy, distributed to hospitals, ambulance, and dressing stations during battle, there will be few if any members of the Corps who will ever be on the fighting line where first-aid can be rendered. Those at the first dressing station will be under the immediate direction of a medical officer, and the occasions will be rare indeed when life or limb will be saved by the individual action of members of the Hospital Corps. In the duties which they will be called upon to perform the knowledge obtained from first-aid teaching will be of benefit, but this knowledge will be mainly called into use when assisting the medical officer, or following his directions. In fact, a large part of first-aid instruction might well come under that part of a nurse's education which is connected with assisting at operations, for the knowledge so gained will be utilized a thousand times in aiding a surgeon to once where it will be used in checking a hemorrhage or fixing a fractured limb. The saying is old that "meddlesome midwifery is bad," but meddlesome first-aid could share the unenviable distinction, when rendered with the little, but dangerous knowledge which the aider usually possesses. The same modicum of knowledge which in a principle would be dangerous, in an assistant would be of great value, and it is as an assistant that the first-aid man will prove valuable. Under direction, he will intelligently prepare splints, assist in applying them, will make and apply compresses and bandages, and will be able to do the many things which, without the teaching incident to first-aid and instruction in nursing, he could not do at all. In this way knowledge gained from first-aid teaching will be of service not only during war in time of accident or battle, but will be useful to the Hospital Corps private in his duties as nurse, both in war and peace. In the same way, while the different subjects in which the Hospital Corps should be so instructed vary in value, they are so related that a knowledge of all is necessary to a proper understanding and performance of the duties of the Corps. The more necessary duties of nursing should not be subordinated to the mechanical performance of medico-military drill, nor should the

necessary drill be omitted. Each has its place, and each should receive its due share of attention in hospital-corps instruction. This being the case, the question naturally arises how instruction should be given. The answer plainly is that, instead of the indefinite directions and discretionary powers given to medical officers by the Regulations, definite rules as to the kind and time of instruction should be laid down.

If four hours each month are to be spent in instruction, greater benefit can be obtained by employing this time in instructing according to a well-defined system than by the haphazard method which now obtains. By establishing a course of instruction covering six months or a year, and detailing the subjects to be covered each week, systematic instruction could be given with some hope of definite result, and with the same course going on at all military posts, having instruction on the same subjects at the same time, there would be no break in the course through change of medical officers.

A medical officer, on his arrival at a post, would take up the course where his predecessor left off, and Hospital Corps privates, in changing station would change instructors, but would continue a definite and systematic course of instruction. As to what the regulation course should be, and what ground should be covered by it, opinions would undoubtedly differ, but a satisfactory scheme could be devised. In considering the plan to be followed, a division into two periods of six months each would seem best. One period could extend from the second week in April to the third week in October. During this half of the year the weather is sufficiently warm and pleasant throughout the United States to admit of outdoor drill and instruction.

This is the time of Summer camp and practice march, and of military activity unfavorable to instruction in nursing, but favorable to litter and ambulance drill and instruction in first-aid. During this time there should be out-door drill according to the drill regulations for the Hospital Corps, together with such practice work in first-aid as is naturally connected with the drill. It would probably not be best to designate definitely the exercises for each drill, but the requirements should be that at the end of six months the medical officer of each post should have his men efficient in the pre-

scribed manual. Four hours drill each month should be rigidly required, and the medical officer should have such extra drills and instructions as he might think necessary.

For the six months beginning the third week in October and ending the second week in April, the instruction should be according to mandatory system, and should cover elementary anatomy, physiology, hygiene, nursing, first-aid, etc. The subjects to be taught each week should be definitely stated, and the medical officer should give such extra instruction, both theoretical and practical, as he might deem necessary.

The following scheme is tentatively suggested:

NO. I.—INSTRUCTION FOR THE THIRD WEEK IN OCTOBER.

- THE BODY. — An Outline of its General Structure.
  - Skeleton ....
    - Axial.
    - Appendicular.
  - Joints.
  - Motor apparatus..
    - Bones, Joints, Muscles controlled by Nervous System.
  - Nervous System..
    - Brain.
    - Spinal Cord.
    - Nerves.
    - The Special Senses.
  - Respiratory, Circulatory, and Nutritive Systems.
  - Body Covering; Nails, Hair.

NO. 2.—INSTRUCTION FOR THE FOURTH WEEK IN OCTOBER.

- THE BODY CAVITIES.
  - Cranial.....
    - Structure.
    - Contents,....Brain.
  - Spinal ..... Spinal Cord.
  - Thoracic ...
    - Structure.
    - Contents .
      - Heart
      - Lungs.
  - Abdominal.
    - Structure.
    - Contents .
      - Stomach.
      - Intestines ..
        - Small.
        - Large.
        - Appendages.
          - Liver.
          - Pancreas.
      - Kidneys.
      - Spleen.
  - Pelvic......
    - Rectum.
    - Bladder—Its connection with the Kidneys and Urethra.

NO. 3.—INSTRUCTION FOR THE FIRST WEEK IN NOVEMBER.

THE CIRCULATORY SYSTEM.

- Heart
  - Structure.
  - Function.
- Blood vessels
  - Arteries.
  - Capillaries.
  - Veins.
  - (Arteries, Capillaries, Veins) Functions.
- Blood
  - Plasm.
  - Corpuscles
    - Red.
    - White.
  - Arterial.
  - Venous.
- The circulation of the blood, the pulse, etc.
- Systems
  - Systemic.
  - Pulmonary.
- Fainting. Shock.

NO. 4.—INSTRUCTION FOR THE SECOND WEEK IN NOVEMBER.

RESPIRATION.

- Thorax
  - Structure.
  - Actions
    - Inspiration.
    - Expiration.
- Lungs
  - Structure.
  - Functions.
    - Blood Change.
      - Arterial.
      - Venous.
    - Air Change
      - Inspired Air.
      - Expired Air.
- Relative to Ventilation
  - Air Space.
  - Air Supply.
  - Ventilation.
  - Heating.

NO. 5.—INSTRUCTION FOR THE THIRD WEEK IN NOVEMBER.

NUTRITION.

- Mouth, Teeth, — Care of, in disease.
- Saliva,
- Deglutition,
- Digestion,
  - Stomachic.
  - Intestinal,
    - Pancreas.
    - Liver.

Enemas.
Constipation.
Diarrhea.
Water, . . Food

NO. 6. INSTRUCTION FOR THE FOURTH WEEK IN NOVEMBER.

EXCRETION.
- Kidneys.
  - Structure.
  - Function.
  - Bladder, Urethra, Retention of Urine.
    - Applications.
    - Catheter.
- Skin. . .
  - Structure.
  - Functions.
    - Excretion.
    - Heat regulation.
      - Baths, giving of, in disease.
      - Use of the thermometer.
  - Care of, in health and disease.

NO. 7. INSTRUCTION FOR THE FIRST WEEK IN DECEMBER.

THE GERM THEORY AND ANTISEPTIC SURGERY.
- Germs.
  - Their relations to wounds.
    - Accidental.
    - Surgical.
  - Their relations to disease.
    - Tuberculosis.
    - Diphtheria, etc.
- Sepsis.
- Asepsis—Aseptic Surgery.
- Antiseptics, . .
  - The principle antiseptics used.
  - Their preparation.
  - The first-aid packet.
- Disinfectants, Deodorants.

NO. 8.—INSTRUCTION FOR THE SECOND WEEK IN DECEMBER.

NURSING IN ITS RELATIONS TO OPERATIONS, AND ANTISEPTIC SURGERY.
- Operations . . . . .
  - Preparations of patients for.
  - Duties of nurses during.
  - Care of patients after.
- First aid. . . . . . .
  - Antiseptic treatment in.
  - The first-aid packet.

NO. 9.—INSTRUCTION FOR THE THIRD WEEK IN DECEMBER.

BANDAGING.
- Bandages. . . . . . .
  - Regular . . . . . .
    - Roller.
    - Triangular, etc.
  - Improvised.
- Demonstration of the different kinds, with practice in each.

NO. 10.—INSTRUCTION FOR THE FOURTH WEEK IN DECEMBER.

BANDAGING.
- Practical work in, continued, particular attention being given to improvised and triangular bandages.

NO. 11.—INSTRUCTION FOR FIRST WEEK IN JANUARY.

- WOUNDS.
  - Kinds ......
    - Incised.
    - Punctured.
    - Lacerated.
    - Contused.
    - Gunshot.
  - Treatment..
    - Cleanliness.
    - Application of antiseptics.
    - Dressings ......
      - Compresses.
      - Gauzes, etc.
      - Bandaging.

NO. 12.—INSTRUCTION FOR THE SECOND WEEK IN JANUARY.

- HEMORRHAGE.
  - Kinds ......
    - Arterial.
    - Venous.
    - Capillary.
  - Diagnosis, differential.
  - Treatment..
    - General rules for, first-aid.
    - Regular and improvised tourniquets, compresses, etc.
    - Of, from wounds of head and trunk.

NO. 13.—INSTRUCTION FOR THE THIRD WEEK IN JANUARY.

- HEMORRHAGE.
  - Arteries and veins of upper extremity....
    - Technical names.
    - Location.
    - Arrest of hemorrhage from.

NO. 14.—INSTRUCTION FOR THE FOURTH WEEK IN JANUARY.

- HEMORRHAGE. .
  - Arteries and veins of lower extremity.
    - Technical names.
    - Location.
    - Arrest of hemorrhage from.

NO. 15.—INSTRUCTION FOR THE FIRST WEEK IN FEBRUARY.

- FRACTURES. .
  - Kinds, . . .
    - Simple.
    - Compound.
  - General rules for first-aid treatment.
    - Of simple.
    - Of compound.
      - Without hemorrhage.
      - With hemorrhage.
- SPLINTS. . . . . Regular, improvised.

NO. 16.—INSTRUCTION FOR THE SECOND WEEK IN FEBRUARY.

FRACTURES. Of the upper extremity.
- Technical names of the bones.
- Fractures of
  - Arm.
  - Forearm.
  - Hand.
- Practical first-aid work in application of splints, etc.

NO. 17.—INSTRUCTION FOR THE THIRD WEEK IN FERUARY.

FRACTURES. Of the lower extremity.
- Technical names of the bones.
- Fractures of
  - Thigh.
  - Leg.
  - Foot.
- Practical first-aid work in application of splints, etc.

NO. 18.—INSTRUCTION FOR THE FOURTH WEEK IN FEBRUARY.

FRACTURE.
- Skull
- Pelvis
- Ribs

First-aid treatment.

DISLOCATIONS.
- Definition.
- Diagnosis.
- Treatment—general rules for first-aid, particularly of
  - Jaw.
  - Shoulder.
  - Fingers.

NO. 19.—INSTRUCTION FOR THE FIRST WEEK IN MARCH,

ARTIFICIAL RESPIRATION.
- Methods.
  - With assistants—Sylvester's.
  - Without assistants—Satterthwaite's.
- Application of, in
  - Drowning.
  - Opium poisoning.
  - Suffocation.
  - Chloroform and ether narcosis.

NO. 20.—INSTRUCTION FOR THE SECOND WEEK IN MARCH.

POISONS
- The stomach pump and tube.
- Emetics.
- Demulcients
- General first-aid rules for
  - Poisoning with acids.
  - Poisoning with alkalies.
  - Arsenic.
  - Strychnine,
  - Opium.

NO. 21.—INSTRUCTION FOR THE THIRD WEEK IN MARCH.

NURSING............
- The Nurse............
  - Qualifications.
  - Dress.
  - Treatment of patients.
  - Relation to his superiors.
- The Ward.............
  - Cleaning.
  - Ventilation.
  - Temperature.
  - Light.
  - Visitors.
  - Clothing and linen.
  - The dying and dead.

NO. 22.—INSTRUCTION FOR THE FOURTH WEEK IN MARCH.

NURSING ...
- Foods......
  - Preparation of foods for the sick.............
    - Beef teas.
    - Broths.
    - Milk punch.
    - Egg-nog.
  - Rectal feeding.
- Administration of medicines.
  - Stomach.
  - Rectum.
  - Skin ....
    - Hypodermically.
    - Inunctions.

NO. 23.—INSTRUCTION FOR THE FIRST WEEK IN APRIL.

NURSING ....
- Application of blisters, lotions, etc.
- Wet and dry packs, baths.
- Disinfection....
  - Excreta......
    - Feces.
    - Vomited matter.
    - Sputum, etc.
  - Dead body.
  - Clothing and linen.
  - Wards and rooms.

NO. 24.—INSTRUCTION FOR THE SECOND WEEK IN APRIL.

NURSING....
- In certain respiratory diseases ....
  - Pneumonia..
    - The special care indicated.
  - Tuberculosis.
    - Regulations regarding the sputum.
  - Hemoptysis...........First-aid in.
- In certain contagious diseases ....
  - Scarlet fever.
  - Diphtheria.
  - Typhoid fever.

I am aware that the above system is open to criticism, and a system which would serve better as a working basis could probably be devised by a board of medical officers; but there is necessity for some definite course of instruction, and this is presented as a personal opinion of matter and method, and of the subjects, a knowledge of which will enable members of the Hospital Corps to perform their duties intelligently and efficiently.

THE LOCATION OF SITES FOR, AND THE CONSTRUCTION OF, MILITARY POSTS IN RELATION TO PROPER SANITATION.

By DALLAS BACHE,
Colonel, and Assistant Surgeon-General, U. S. A.

Of the three considerations which govern the location of army posts — military necessity, convenience, and health — it is safe to say that the third has been the least consulted and the least intelligently understood. It is doubtful whether it has ever cast the deciding vote in a tie between the other two, and it is even more doubtful whether, for the sake of health alone, other reasons being indifferent, a permanent military site has ever been chosen.

And this neglect, or casual attention, is not so strange as it might otherwise seem, when we reflect than sanitary prudence and foresight are not apt to mark the individual even in the selection of a home, nor any body or assemblage of men in determining the site for a town, city, or enterprise. Commercial advantage, primary accessibility, some temporary gain, or beauty of prospect, have been the energetic and persuasive arguments, and the sanitary engineer, assisted by the municipal tax, has been left to contend with a multitude of refractory evils adopted with the site. Commercial necessity is as inexorable as military necessity, and the deep and secure harbor that has created the city will demand the fort for its protection; but outside of this narrow obligation there are abundant occasions for judgment and scrutiny.

Aside from the histories of the permanent defensive works located upon our maritime coasts, and, to a small extent, on our navigable inland waters, works, whose situations are necessarily forced by strategic necessity, the story of the choice of sites for our multitude of interior military posts would form a most interesting and illustrious chapter. They were placed far to the front of the inquisitive and

hardy miner, years in advance of the most restless emigrant, in the thoroughfares of active and hostile Indians, in deserts, on mountains, in tropical heat, or in the snow, anywhere where danger was thick; and I am afraid that the concern was more for wood, water, and grass, and not much for ground, air, and the bacteriology of the soil. You will hear these posts, originally built of logs, cut on the site, or perhaps at a great distance, or of the sun-dried brick, and later, of increasing dignity of construction, called forts; and, by an accepted use of this term, they are called so to this date. In fact, very few have had any strictly defensive purpose whatever, a certain compactness of arrangement being the only illustration in that direction; they have been, and are more properly cantonments, often ephemeral, sometimes reoccupied, losing their value on the settlement and cultivation of a country, and finally extinguished by the Interior Department. I would like to pay their glorious memories a tribute greater than this, but I will at least ask an absolution for their sanitary sins. Yet errors were committed in the location of those older posts, which the exercise of ordinary prudence and sagacity should have prevented; errors which entailed a calculable loss through an excessive sick rate, or an increased expenditure to remedy evils that appeared at once on occupation and after consideration, or even forced an early abandonment.

Admitting the necessity for the establishment of any particular post, its defense of a defile, its appropriation of an isolated water supply, its protection of a frequented emigrant route, or its supervision of an Indian reservation, the sanitary choice of a particular site should be justified.

Such precautions would have prevented the removal of Forts Lyon, Colorado, and Gibson, Indian Territory, to locations less malarious than their original sites; they should have promoted a further search for a site less objectionable than that of the present Ft. Leavenworth, Kansas; they would have made unnecessary such medical judgment as this about Ft. Dodge, Kansas: "there is a much better (healthier) location a few hundreds yards distant, on an elevated plateau," or this of Ft. Larned, "there is a much better location for a post about four miles down the creek;" and it is within the experience of many medical officers of the regular service that their duties would have been lighter and more satisfactory as

preventive sanitarians, if location of even the most transient of such posts had been made after medical counsel. Other and grave disabilities, chiefly concerning the disposal of waste, are inherent to an occupation of the soil, known to be transitory, but often prolonged for many years. The cess-pit, and what may be called the open treatment of liquid waste, still afflict some of our remote and less-considered stations; but these pardonable errors are restricted by intelligent treatment, and are not likely to be repeated. We may consider them the sins of our fathers, to be extenuated in forgiving silence, but to be avoided as an inheritance.

As you know, however, we are withdrawing our troops slowly from the artificial frontier created by the Indian, to stations along our Canadian and Mexican borders, and to others near by the large commercial centers, where supply is easy, and the utmost facility for rapid distribution by rail can be had. It is to these newer military posts, with their improved construction, larger garrisons, increased expenditures, and greater liberty of choice, that we have a right to look for the application of known sound sanitation in the selection of sites, and afterward in construction. We are no longer in search of wood and grass, for we can have coal and baled hay, and we are seldom bound by any severe military convention. Water, however, will always remain a prime necessity.

I say that I think we, who should be the counselors in matters of preventive medicine, as we must be in applied medicine, have reason to expect that certain sanitary interrogatories will be put to any important situation, and the replies carefully considered before placing permanently our large military populations; and later, when these communities are housed—in barracks, quarters, in hospitals, or places of confinement—the buildings shall answer reasonable sanitary requirements. These posts are already scattered over a wide extent of territory, as a list of names and places will show: Ft. Ethan Allen, Burlington, Vt.; Plattsburg Barracks, Plattsburg, N. Y.; Ft. Sheridan, Chicago, Ill.; Ft. McPherson, Atlanta, Ga.; Ft. Sam Houston, San Antonio, Tex.; Ft. Bliss, El Paso, Tex.; Ft. Riley, Kansas; Ft. Crook, Omaha, Neb.; Ft. Logan, Denver, Col.; and two unfinished and unnamed, one at Helena, Mt.,* and the second near Little Rock, Ark. Besides these, others are contemplated as garrisons are released from Indian control, and concentrated for

*Since named Ft. Harrison. [ED.]

convenience of supply and rapid distribution for emergency. Manifestly a very great range of questions upon climate, soil, water, and waste disposal must be met, and construction must be adjusted to many varying conditions.

It will be naturally said of the location of many of the posts just enumerated, and certainly in reference to those situated near by large cities or towns, that so far at least as climate or general meteorological conditions are concerned their communities will fare as well as the adjacent city or town populations; and this is true in a general way of the air, the direction and velocity of the winds, the rainfall, and the degrees of heat and cold. It may not be true, however, with regard to other important influences and conditions, as we will see. There is a tendency, I think, to regard the earth's surface with comfortable composure, and to look upon it as habitable without much reference to what lies beneath; configuration, dampness, and stones attract the eye, and about these there are convictions; but the deeper exhibits of the soil—its air, water, temperature, and associated mineralogy—are either presumed to be inscrutable, or something for the builder to consider. Yet these qualities, attributes, or modifications of the soil have well-established or highly probable relations to health, and one or another, or in cooperation, they certainly contribute to the origin or spread of known diseases, which it is the business of the sanitarian to modify or prevent.

Being then informed of the climatic conditions, in which are included such as are common to altitude, the direction and velocity of the winds, the amount of rain and snow, the range of atmospheric humidity, the amplitudes of heat and cold, the prevalence of fogs, mist, or dust conditions which may be termed as regional or of general significance, the next consideration should be given to the topography of the site, the conformation or "lay" of the land. The practiced eye of an engineer would reduce this view rapidly, but the craft is to be acquired with a little application, and a knowledge of what is to be sought and what avoided. Perhaps shelter from Winter winds can be obtained under the lee of hills or higher ground, or a ridge can be secured affording excellent natural drainage, or with the prevailing Summer winds from the south they reach you over a river delta; these plain considerations of the place are of

great moment. There are sites at the bases of mountains or lofty hills, or on their elevated benches, of eastern or western exposure, which are objectionable because of the diminished duration of sunlight, or because of the chill of the Summer night from the down draught of the colder upland air through some cleft. There are localities not fifty miles apart, and to a superficial view much the same, yet the one is secure and the other habitually swept by a tempest of wind. And let me say, parenthetically, that there is a malady of the wind, as there is of the sea. Some smooth stretch of grass land may be attractive, but it is shut by hills and, therefore, may be damp, cold, and illy ventilated; or it is plainly alluvial, flat, retentive of water, difficult to drain and, therefore, to be avoided. There are a multitude of similar considerations which will occur to you as to localities with which you are familiar, subjects of every-day comment and observation, all of which must enter into any deliberate sanitary inquiry of a site.

Then as to the composition of the soil, organic and mineral, and its color. Is it humus, sand, gravel, or clay; porous, permeable, or retentive; does it absorb and retain heat, or is it quick of radiation? For it matters much what air, and water, and heat are in the ground.

The subject of ground-air and ground-respiration has interested many investigators, and you will readily recall the names of Pettenkofer, Fodor, Fleck, Nichols, Hunt, Lewis, and Cunningham as unavoidably quoted in any review of this and related attributes of the soil. I think we need figures to attract our attention to this matter. We do not readily associate air with rock, or with the denser and more compact earths, such as the clays, yet it is contained in rocks, according to their density, in proportion of six to thirty volumes to one hundred; it may form fifty per cent of loose sand, and in pulverized agricultural soil it reaches, according to Parkes, a ratio of even ten volumes to one. It is an aerial tide, rising and falling with the ground-water, moving readily in all directions, drawn upward and laterally for great distances by forcible aspiration, and is a common carrier for good and evil. Among the objectionable freight is carbon dioxide, as the result of organic decomposition, in which some soils are exceedingly rich. Nichols found from 1.49 to 2.26 volumes per 1,000 in the Back-Bay land of Boston; Fleck, in

Dresden, 29.9 at two meters, and 79.6 at six meters; Fodor, Buda Pesth, as high as 54.45 at four meters; and Pettenkofer records eighty volumes per 1,000. Most of these are irrespirable airs, some would extinguish a light, and they all point to intense chemical changes in the ground. These changes being more or less active under conditions affecting the temperature of the soil, there is an approximate correspondence of the curves of carbon dioxide production and ground-heat, the maxima being reached in July and August, and the minima in January and February. Setting aside, however, a nicer analysis, it is not difficult to understand how this vast slow respiration of the soil, using almost one-third of its volume of air, may affect us in our dwellings, or our occupations, as this air is exhaled from the warm soil at night, or is displaced by rain through dry and protected areas, or is driven upward by the rising water-table; or, sealed beneath the frozen crust of earth, it is aspirated through pervious cellars, and loose foundations, into our heated houses.

Now, the soil has another capacity that interests us, perhaps even more than its capacity for air—its appropriation of water. Here, again, the nature of the soil explains the variable results. Humus may take up as much as forty to sixty per cent and retain it strongly, chalk about fifteen per cent, and moderately loose clay twenty per cent, and it is said that loose sand is capable of holding as much as two gallons a cubic foot; so that, under most circumstances, the absorptive power of the soil is very great, no rock being absolutely moisture-free; variable percentage of rain, twenty-five to sixty per cent penetrating all soils, under the limitations of density and slope. Plainly, too, the conditions of the surface, together with the depth and nature of the strata immediately underlying, will give an inconstant level of the ground or subsoil-water, described as "a continuous sheet," constantly seeking an outlet, with a movement increased or retarded by the inclination of the retentive stratum, and distant from the surface a few inches or many feet; a fluctuation, partly seasonal, but depending mainly on the impermeable floor. And here let me say that the flow and feed of this subsoil-water is toward the river and streams, and that pressure in a river, by tide or freshet, will retard its output greatly. DeChaumont records an instance of this kind, in which pressure from the river

Hamble, in Hampshire, affected the water of a well at a distance of 2,240 feet, the well itself being eighty-three feet deep, and 140 feet above the mean tide level. The special application of this is to discourage attempts to secure river water by digging wells in or near their banks.

And there is yet another soil complexity. The temperature, having also, as above the surface, its diurnal and annual curve, the denser medium of the earth preventing sudden and violent fluctuations, and retarding the rise and fall. In temperate climates this diurnal wave will reach a depth of about four feet, receding during the night; the annual wave penetrating from fifty to one hundred. The gain of heat by a soil for a few feet below the surface may be very rapid and considerable, a dark loam, unprotected by grass, gaining as much as 18 C. in two hours. Sand will heat much more rapidly than clay, the temperature on such a surface reaching 122 F., and even 159 F.; but, generally, it may be received as true that the richer the soil in organic matter the greater its power of absorbing heat. As a rule, soils cool more rapidly than they heat. Of course, dampness retards heat absorption, and the loss of heat is also correspondingly slow. The dry and porous soil will, therefore, be warm, and the wet and compact will be cold. It would be interesting to copy here some of the tables relating to the heat of soils, both of the surface and deeper layers, but it seems sufficient to say that this heat gained from the sun extends, according to the nature of the soil, and with diminishing effect, to the depth indicated, from fifty to one hundred feet, where the temperature is practically stationary.

I am not inclined to be fiercely differential in these matters of the soil, nor to draw too closely and rigidly the relations of its air, water, temperature, and chemical changes, to specified disease. I do not think we have the warrant for some of the positive deductions made, and as to others we may be indifferent, because either the diseases are infrequent or they are inconsiderable for our purpose; but within the limits of site selection, where the question is what soil is best suited for health and not how shall we build upon it, we can not afford to neglect the evidence that makes a close ally of soil with malaria, and proclaims it the nursery of neuralgia, catarrhs, rheumatism, and consumption; more constant and insidious foes to the military community than the Indian, and much more perplexing to the sanitarian.

We are not committed by this recognition to any assumption of causation, and we do not seek in the soil the etiology of all these diseases; but we are bound to show a philosophical hospitality for well-attested facts, and we may not reject certain reasonable inferences in our conduct. The particular poison of malaria does exist in many soils, and under conditions not always conformable to the general theory; but we do know that given a soil rich in the products of vegetable decay, freely supplied with moisture by rainfall or from the ground-water, especially if the latter is stagnant and superficial, and combine these with a soil temperapure of about 65 F., and we may confidently predict malaria in some of its manifold forms. Whether principally water-borne or not, its aerial carriage can not be excluded, and no one should willingly, or except as the outcome of proved necessity, choose a military site subject to these conditions. We may not be agreed as to the significance of the bacillus tuberculosis, and uncertain as to the biological factor, but there is abundant proof that dampness of soil is a preparation for phthisis, and for the respiratory surface conditions which it subsidizes; nor is it all improbable that we have to reckon with rheumatic fever as a parasitic infection favored by tonsilitis, immediately due to the same local influence.

There are, of course, other diseases or conditions disposing to infection with which the physical factors of the soil have much to do, but which are aside from the selection of sites, because the soil in these others offers itself as a culture medium or refuge on general terms, and their exclusion is best accomplished by safe-guards to the water supply, and by careful construction. Such diseases are cholera, typhoid fever, and probably diarrhea and dysentery. The correspondence, for instance, between a soil temperature of 56 F. at four feet and epidemic diarrhea is an interesting and instructive record, but obviously it can not be made useful for our purpose. And as to all these diseases where the carriage is largely through the water we drink, the remedy is evidently not so much in the choice of a site for building as in the perfection of our construction, and in the protection of the water.

We have then, in a rough valuation of the hygiene of soils, to avoid locations that are wet, either from the retention of the ground moisture or by the high level of the ground-water; such soils, in

fact, as are largely of clay, or underlaid with clay and other retentive strata, and the more especially if these are not so inclined as to promote rapid drainage; and we should look with suspicion upon sites deeply enriched by vegetable decomposition, unless in addition to their free permeability they rest also upon a permeable bed. Loose, dry, porous soils are to be preferred, with a combination of surface slope and underlying stratification that promise a low water table and a rapid outlet.

There is nothing new in all this, and yet these plain indications are at times ignored. I have in mind an expensive and important military site, not of compulsion, selected some six years ago, and so far as I know without medical or expert consultation, as to which the following soil conditions exist, as shown by the boring for the wells which are to furnish the water for all purposes: The soil is about 100 feet deep, and is supported by limestone; there is a top dressing of black earth, plainly alluvial, of slightly varying depth, from two to seven feet, and the rest is clay, yellow and blue, showing here and there seams of water, and some interrupted deposits of peat. This site includes upon the north some high ground of rapid slope, toward the foot of which many of the dwellings are built, but the main occupation is of the lower level. The general territory of which this is a part is the floor of a river valley, almost flat; the prevailing Summer winds are from the south, with a mean annual precipitation for the region of thirty-two inches, and a mean temperature for June, July, August, and September of 71.3 F. I do not know the seasonal variations of the groundwater, but the retentive clay must keep it near the surface and, in fact, when preparing the foundation of some of the larger buildings on this plain it was continually necessary to free the excavations with the pump. The subsoil water-level was then within a foot of the surface. It is not unsafe to foretell for this post abundant malarial infection, and a probability of other disorders, due to a damp site, and a by no means assured water supply. There is, fortunately, as an offset to the reproach of this site, an admirable and thoughtful construction, coupled with some but not extensive deep drainage of the occupied area; but all this and more preparation is entailed by soil conditions which should have been avoided by prudent examination. The hospital for this post, I may

say in passing, is placed on a high, well-drained ridge, locally free from objection, but the water supply is, of course, that of the post.

And this brings us to the consideration of water supply and the disposal of liquid waste, correlated matters, which for the present illustrative purpose can best be considered together. Of course, if a lake is available, as at Ft. Sheridan, or a river, as at Ft. Snelling, and there is no pollution of the intake and the discharge of sewage is obnoxious to no one, these questions offer no difficulty; or, if there are suitable springs on a protected area, there need be as to the water only the chemistry of the water itself; or, if the adjacent mains of a city are, and the city's supply is wholesome, there is a ready solution. But it is often otherwise as to both water and sewage, and sites have been selected within recent years where it was not plain how water was to be obtained, and what was to be done with it as a carrier of waste. In the older days, for which I have asked a remission of sins, these things were much simpler. The water barrel at our kitchen door was filled, and the garbage barrel and cess-pit completed the round; but there were no stationary bath-tubs and no water-closets in those days, and with these have come other demands for disposal. One of our newer posts obtains its water from two artesian wells, some twelve hundred feet deep, and its liquid waste flows upon a sewage farm, not owned by the Government, nor under its direction, and therefore subject to discontinuance from causes utterly beyond the public control. In this case potable water could not have been absolutely predicted, although the general region is one of frequent artesian supply; and the sewage farm, being a private enterprise, can not be regarded as other than a temporary expedient liable to interruption, and therefore a method of waste disposal inconsistent with hygienic security.

Nor is there a stream to receive this sewage in the event of the withdrawal of the present advantage. And in the other instance whose soil conditions I have discussed, the alternative of finding a satisfactory water supply by well-boring was an expensive connection with the mains of a city suburb some five miles distant, entailing an undesirable dependence, and the payment of water rates. Here, again, the treatment of the sewage promises to be unsatisfactory, the delivery being into the channel of a small stream to the south, whose volume in dry weather is insignificant, and where a

resulting nuisance may produce annoying, if not successful efforts at legal restraint.

If we are restricted to lakes, to large rivers, or considerable streams, and to locations upon these which do not invade the rights of others, for our sewage disposal, it is evident that we may be very seriously limited in the selection of sites, the more especially if our important garrisons are established near extensive civil populations; and it may occur that sites otherwise desirable may be rejected for want of some of the sewage outlets indicated. I have given much thought to this difficulty, not only as to this contingent phase, but as to the actual instances which have been detailed, and am of the opinion that we have a remedy in the system of sub-surface irrigation, as applied by Waring, in this country, at Lenox, Mass., and elsewhere. The conditions for the success of this method are not difficult—a sufficient-absorption field, a porous soil not subject to very deep frost, and intelligent treatment. Of course, the level of the ground-water and the direction of its movement would have to be considered, and if wells were to be used, care taken in placing them. I am not aware that this distribution has ever been considered in the selection of any military site, and the more obvious methods will secure attention for themselves; yet, the pollution of streams, or the failure of some method in use, may earn for this apparent means a military illustration. The complex care of a sewage farm is not to be advocated for military adoption.

If in the discussion of these physical properties of the soil I have not anticipated certain advice as to the construction of the dwellings to be erected for military use, you can readily forecast much that I have to say; for the matters that concern the health of the individual as to his dwelling are the materials of which it is built, its relation to the soil, and its arrangement—including in this term, capacity, ventilation, heating, lighting, water supply, waste disposal, and the distribution of parts; in short, the intelligent fulfillment of a purpose.

Our military communities are now large, are likely to be strengthened, and the buildings needed for their varied use are much diversified. We may consider such posts as containing a regiment of infantry, or its equivalent in mixed arms, and the ordinary civil population attached. There will probably be at least 700 people to be

provided for, and a few posts have populations already in excess of this aggregate. The buildings are numerous, for there are not only quarters for the officers and the authorized non-commissioned staff, and barracks, either separate or combined, for the men, but there must be a hospital, a place of confinement for the disorderly, store-houses, a bakery, stables, shops for repair, and a place for central administration. Besides these, there may be a gymnasium, a riding hall (serving also for in-door drill), and, if we are wise, a crematory for garbage. It is a composite community, not wholly military, yet closely knit, of similar interest, and largely dependent for health on the local hygienic conditions, for which the general Government is ultimately responsible.

I am thus particular in this sketch, because I think no one, unless familiar with our military posts, would anticipate the amount and character of the construction required, and the great necessity for skilled direction. We have been content in the places of our transient military refuge, and because of that controlling idea, to build upon or slightly above the surface of the ground, and of perishable materials, but respect for permanency, and an understanding of soil conditions will no longer permit this; and, so far as I know, without exception, recent construction has observed the necessity for making cellars impermeable to ground-air and moisture, and either stone or brick have been used as general material, depending naturally on the local market supply and price. Between these two materials there does not seem to be any distinct choice, provided the brick is well baked and compact, a porous stock brick being always objectionable on account of its capacity for water, estimated at a pint for each brick, under favorable circumstances.

Perhaps I can treat this division of my subject, which concerns the dwelling, with more satisfaction to you, as well as to myself, by neglecting for a moment subjects about which there is little dispute, and pointing, with some emphasis, to defects which are the most frequently reported by medical officers in the monthly sanitary reviews of their posts; and as to which the cure is not always plain, and is sometimes impossible.

I do not know that we have anywhere, fixed by authority, an allowance per man of floor area, cubic air space, or any fixed ratio of air renewal. It is true that certain approximate standards are consid-

ered desirable, and a growing deference to these, as to other sanitary requirements, is evident in all the plans and specifications for military barracks; but, aside from a very serious disturbing element, which I will mention, there has been a divergent practice. I think it may be stated as practically correct that a superficial area of about fifty square feet, and a cubic air space of 600 feet, without definite and known air renewal, but a supply not exceeding 1,000 cubic feet per hour, had come to be thought a liberal allowance; but if it can be fairly demonstrated that a healthy adult male should have eighty square feet of floor space, 1,000 cubic feet of air space, and that this air should be renewed three times in each hour, what is gained by understating the sanitary necessity? It may be that we regarded our practice as generous, because we have not forgotten our barracks that were like columbaria with the two-storied bunks, when 300 cubic feet of air space, and what renewal chance and poor construction afforded, was the rule. The former figures I have given agree also with the present English standard, as to which some of their prominent military hygienists appear content; mainly, as it seems to me, because their barracks were formerly as bad as ours, and some of their usage much worse.

If you have a barrack dormitory, and of this type there are frequent examples, 60 x 24 x 12, giving a floor area of 1,440 square feet, and a cubic air space of 17,280 feet, a room which, with deductions for occupants and furniture, could properly contain seventeen men, and you put in it twenty-five or thirty men, as you must often do, you economize in the cost of so much of the barrack per man; but you assume a risk to his health, which is to some extent calculable as to its probable expression in disease, and, therefore, can be reduced to terms of loss in efficiency. Or, take the most liberal allowance of dormitory area with which I am acquainted in recent design, a room 46 x 40 x 12, two such dormitories being assigned to each company. Here is a cubic capacity of 22,080 feet, and a superficial floor area of 1,840 square feet. For this we will assume an occupancy of thirty men, and we get a per capita ration of air of 736 cubic feet, omitting deductions; of floor space, 61.3 square feet, but a supply of more than 2,200 cubic feet of fresh air per hour is not possible without draught. This is, in dimension, and I must limit myself to this admission, a long step forward, but it is yet a halt short

of what is to be desired; an understatement, as I repeat, of the sanitary necessity.

And this brings me to the statement of a difficulty which, as I have said, is not only impossible of remedy, but goes far to vitiate the best conceptions of the architect and constructer. The strength of our companies, and the company is the practical unit for construction, is not fixed by law, but varies from time to time, according to what may be called temporary demands ; neither the number of companies or troops in a regiment, nor the enlisted strength of either being so determlned that an architect can assume in his plan for a given organization, that any "ration" of air or space agreed upon as proper can or will be given to the soldier.

It is true that the Revised Statutes, 1874, provide an enlisted strength of sixty-five men for each company of infantry, with an emergency provision for fifty privates more, and for a troop of cavalry an enlisted strength not exceeding ninety-five; but the whole enlisted strength of the Army, as authorized by existing laws, is assigned to various organizations by orders from the War Department, resulting in various temporary distributions, and increase of one arm of the service, and a corresponding decrease of another. A company of infantry now consists of sixty-five enlisted men; in 1877, the enlisted strength was thirty-seven; and in 1884, it was forty-eight.

Manifestly, there will be a great variation of barrack occupancy, and on occasions serious over-crowding, complaint, and sickness; and unless the original construction contemplates a margin for possible increase of company strength, correction of the evil is impossible. But, in spite of this imposed burden, the general provisions of our modern barracks are extremely generous. The internal administration of the company is justly consulted, and the arrangements for personal convenience are often elaborate. It would be impossible to ask for better kitchens, dining-rooms, day-rooms, bath-rooms, lavatories, and water-closets than I have inspected recently, nor a more earnest purpose to excel on the part of officers charged with construction. My only criticism is that the excellence may be individual, depending on the skill, experience, and taste of the constructer, and not absolutely upon the excellence of the central directing intelligence. Thus, also, mistakes arise from personal inexperi-

ence, which are difficult and expensive to correct, while it is conceivable that any pleasing diversity of design and appearance, if due to personal suggestion, might as well be attained by central control, and with the same uniform excellence of construction.

It does not appear to me that there is need, in a paper of this kind, to state, except in general terms, the fundamental necessity for the isolation of all bath-rooms and water-closets, for their separate ventilation, for the best plumbing material and workmanship, and the greatest nicety of adjustment, grade, and integrity. In no other way can pollution of air and soil be prevented, and such care is a wise economy. It is not necessary to place these facilities in a detached building, but it is necessary to exclude them from the general air circulation of the dwelling. So also the means for the distribution of heat, and the special mechanism for ventilation, these seem to require only the same brief treatment here. Almost every device known, and every principle of heating has its illustration in our quarters or barracks to-day. Stoves of all designs, open fireplaces, hot-air furnaces, steam and hot-water radiators, direct and mixed methods are in use, according to climate, permanency, and perhaps the genius of the constructer. In one instance, that of the important Cavalry and Artillery School at Ft. Riley, Kansas, the steam plant is central, and a very large number of buildings, covering a considerable area, are, I believe, satisfactorily heated.

I delay here to express an individual judgment upon two points, the large barracks intended for a regiment or more, and the separate bath-rooms for companies. I am of the opinion that experience will prove the collection of so many men under one roof, although there is a division of parts, to be a hygienic mistake, and in proportion to the density of the barrack population. Separate barracks, or pavilions, should be able to demonstrate their superiority, aside from any question of cost or convenience of concentration. And, conversely, as to the bath-rooms: I think all such facilities should be concentrated, to secure uniform care, to enlarge the bath provision itself, and to rid the barrack of possible offense. So much of this argument is for health, but such a distinct administration would facilitate an improved system, replacing many of the tubs by stalls and the jet-bath, and it would allow the great addition of a bathing pool. Such a general bath-house under one head should prove an advan-

tage in the ways indicated, certainly a gain in precision; and an objection sometimes raised against it on the score of exposure and danger to the bather is not justified by experience. This general bath-house could properly be combined with the gymnasium. For the purpose of showing that this and similar provisions are already liberal enough in the latest construction, I give the allowance of each in a barrack just finished: Each company occupies two floors, on the lower of which are seven water-closets, three urinals, and five lavatory basins; and upon the upper, four bath tubs, with the same allowance of urinals and basins. This gives seven water-closets, six urinals, four bath tubs, and ten basins for an average occupancy of sixty men. The present English allowance is one bath, five latrine seats, five urinal spaces, and twelve basins to one hundred men.

And now that I have advocated this scrutiny of the soil, and this care of building, what is its justification in a demonstrable gain of health? What will be saved of life or efficiency in these barracks of hygeia?

And I say that we can not assign so much gain to the avoidance of damp sites, so much to a pure and sufficient supply of water, thus and so to the removal of waste, the allowance and renewal of air; but that no fact in history is more clearly proven than that the intelligent direction of means calculated to secure this collective sanitary care, and so to diminish the mortality, disability, and suffering due to preventable disease, has been one of the most beneficent results of applied science, whether we reckon the gain in the lengthening and saving of life, or express it in the sum of money saved to the individual or the State.

It has been well said that nothing is so costly as sickness, so that even commercial employers have come to recognize this in their efforts to control and protect their working communities; and there is added for the Government, as sponsor for the military and naval services, an obligation as imposing upon them in its employment conditions of life no longer voluntary, but enforced. While it is admittedly difficult to fix a norm for disease and mortality, and thereby to approach the ratios of preventable sickness and death, there are some figures which will help us to a conclusion, not only in relation to population at large, which does not concern us here, but as to such a smaller group as the Army.

Let us consider some comparatively recent figures, whose accuracy is not questioned. The average death rate of our Army, for disease alone, for the period of 1840–59, not including the years of the Mexican War, was 18.98 per 1,000; while, for the decade ending December 31, 1886, it had fallen to 10.23 per 1,000 from all causes. During the decade ending 1893, it had fallen to 8.51, and for the year 1894 to 6.91 per 1,000. Excluding accidents and injuries, the death rate for that year was 4.01; while for 1889, it touched its lowest record, 3.95 per 1,000. Before the Crimean War, and therefore preceding vigorous efforts at sanitary reform, the death rate of the English Guards in London was 20 per 1,000, and mainly, we are told, from consumption; while for the general infantry it was about 15, and for the cavalry 18 per 1,000. For the year 1892 the death rate of all troops serving in the United Kingdom was 4.38, and for the period 1882–1891 it was 5.73 per 1,000. And what makes these rates of mortality the more significant for ourselves — for I have not the corresponding figures for the other service—is that the ratio for disability discharge has diminished in like proportion, proving that the death rate at least has not been decreased by the early discharge of serious and probably fatal cases; for this discharge-ratio, which was formerly thirty and more per thousand, has now fallen to about fourteen, and with a tendency to diminish.

I do not assume that all of this gain is due to improved hygiene alone, for there are other co-operating causes; a more rigorous examination of recruits, which rejects material that would swell the death and discharge lists, and there is greater skill in preventive medicine, in its practice, and in surgery; but it is plain, when we consider the results of similar application of sanitary science elsewhere, and to populations at large, that the greater gratitude is due to those who have labored to improve the physical condition of the individual and his surroundings. My judgment is that we are approaching a norm of about three deaths per thousand living—from disease — in substantial agreement with the estimate of Chadwick, for adults of the ages of the prison populations; and that any grave or continued excess over this we may fairly consider to be avoidable, and capable of sanitary restraint.

The mean daily ineffective for the year 1893 was a fraction over four per cent of the strength of the Army, in small excess over

25,000 men, giving a daily sick list of about 1,000 cases. It has been calculated that nearly one-half of this ineffective is due to preventable causes, which would reduce the unavoidable sickness to two per cent of command. Under favorable circumstances this hypothetical norm has been lowered, the daily ineffective at Ft. Snelling, for instance, for 1893, being but 1.5 per cent, and that of Ft. Custer, 1.3 per cent of command.

I think we should not be content, in our capacity of sanitary counselors, to allow the good to be an enemy to the better, nor be discouraged by a temporary displacement of our ideals. If we certainly know the cause of the displacement it will be much to a recovery. In places of compulsion, and at times, these causes will be beyond our efforts to remove, but never to palliate in effect; and I feel confident that we shall gain a little here and there along the lines indicated in this paper.

We have largely passed through the unusual conditions which compelled our Army to be distributed, as it were, in open skirmish order over the continent, and where we build and what we build now will influence us and our successors permanently. The construction of posts, unless it is seriously hampered by unwise economy, seems safely directed toward an unusual perfection, wanting only a full confession of sanitary supremacy; but, until, in the selection of sites for such posts, we have replaced our present sterile methods, by an association of the engineer and the medical officer, who is, also, an expert sanitarian; and, until these, informed of external conditions, investigate patiently the concealed conditions of the soil, and can say how water is to be procured, of its quality, quantity, permanence, and what is to be done with the effluent waste, we will not have justified an excellent construction, nor done our best to anticipate and prevent avoidable disease.

THE EFFECTS AND TREATMENT OF HEAT AND SUN-STROKE AT CAMPS OF INSTRUCTION.

By LIEUT. ORLANDO J. BROWN, Assistant Surgeon, M. V. M.

In camps of instruction during the Summer months, at ceremonies like dress parade, review, and occasionally while standing at rest on the line of march, it is of frequent occurrence to witness men fall to the ground limp, and often unconscious. So common is this that experienced commanders do not forget to require the medical officer and ambulance corps to be stationed near, in order that the quickest possible aid may be rendered. In quarters, likewise, men are occasionally known to suddenly fall, or even in sitting or in lying posture to manifest symptoms of syncope, with partial or complete unconsciousness, coma, or convulsions.

These cases sometimes occur at night. The experiences of military surgeons in meeting this class of cases are alike, yet medical authorities in their description and treatment of them differ widely. That a high atmospheric temperature is the exciting cause of these ailments all are agreed, but many authors describe all these cases under one term, viz., sun-stroke; others classify the same conditions under several different heads, as sun-stroke, solar asphyxia, thermic fever, heat-apoplexy, meningitis, ictus solis, heat exhaustion, insolation, calenture, erythismus tropicus, and other similar titles.

To Prof. H. C. Wood, of Philadelphia, belongs the credit of giving to the profession, to my mind, the ideal classification of these cases. In his famous prize essay upon this subject, written in 1872, he describes as the result of excessive heat *two classes of cases*. One embraced under the term heat exhaustion, which is like exhaustion from any other cause, the other under the head of thermic fever or sun-stroke, of which heat, solar or artificial, is the absolutely necessary and ever-present immediate cause. That a third class, due

wholly to exposure to the sun and direct action of its rays, may occur he does not deny, but believes cases of this kind very rare, having never seen or read an unequivocal record of such a case.

Of the two classes, heat exhaustion, in my opinion, occurs much more frequently than sun-stroke. In my experience the type of men more likely to suffer from either of these conditions has been the habitual imbiber of alcoholic stimulants, those unaccustomed to fatigue and active exercise, those of debilitated constitution, also those of poor proportionate build, being too slender or again too heavy for their height. The determining causes, as I have watched these accidents, are overwork, overstimulation, loss of sleep, indigestion, irregularity of the bowels, febrile state from any cause, *e. g.*, malaria, and warm, buttoned-up, tight-fitting coats, heavy, hot helmets, and tight belts. With these causes acting upon the type of men described, it is easy to understand how the nervous system becomes oversensitive and is rendered prostrate by excessive heat, which in this instance may be called a morbific agent.

The causes enumerated interfere also with the entire glandular system, so weakening its action as to interfere with secretions, the evaporation of which enables the body to resist external heat. The circulatory system is also affected. Our organism is constructed to run upon a certain plain of temperature, any departure from which will cause impairment of all functions. While we admit, then, that excessive heat is the morbific agent that causes heat exhaustion and sun-stroke, we assert that rarely can the direct action of the sun's rays upon the men be considered a cause of their indisposition.

In fact, during eighteen years' experience in the military, I noticed most cases of heat exhaustion and sun-stroke occurred when the sun was wholly obscured by cloud and mist. A moist atmosphere, tending to prevent evaporation from the surface, is a more depressing agent than the direct rays of the sun. Where men are said to be knocked out by excessive heat, like causative conditions exist pretty constantly. Bearing the correct symptomatology of these conditions in mind the surgeon can do much to avert these accidents. This may be done under his general line of duties in seeing that hygienic measures are enforced in every particular. But he can do more than this—he can give special instruction to all those coming before him at surgeon's call. A word of kindly advice

given to men slightly indisposed may many times prevent serious results. Prophylaxis should be the rule. He may restrain the overambitious soldier from doing full duty, even if it is contrary to the wish of the recruit. He may order a postponement of drill or ceremony on account of unsuitable weather; he may have recall sounded at any time for like reasons; he can insist on men wearing clothing suited to the prevailing atmospheric temperature, and he should be on the general lookout for accident, especially when moist and oppressive heat prevail.

Men engaged at ceremonies, or performing any duty requiring great steadiness and close attention, often unconsciously have slight tremor, become jerky, unsteady, and assume a deathly pallor prior to falling. The medical officer, cognizant of a case of this kind, should at once order the man from the ranks, or if on guard duty see that he is at once relieved. I can recall instances of this kind where personal thanks have afterward been tendered by private and officer for timely interference. They testified that their minds being so intent on their duties no sense of overheat or exhaustion was experienced by them until ordered from the ranks. These preventive measures are particularly applicable to new recruits. Notwithstanding the enforcement of prophylactic measures these accidents will occur, and permanent results and fatalities follow unless prompt and efficient treatment be administered.

Heat exhaustion and sun-stroke are due to the same cause, and resemble each other in general characteristics; but upon closer examination we find certain symptoms which prove the type of the two conditions to be entirely different, requiring essentially an opposite line of treatment. The victim of typical heat exhaustion has a temperature markedly sub-normal, often falling as low as 95° F.; he has profuse cold perspiration, muttering delirium, irregular breathing, great restlessness, partial or entire loss of consciousness, rapid, feeble pulse, and a facial expression of collapse. There seems to be respiratory, circulatory, and glandular failure. The nerve centers presiding over these important functions being too weary to act. The treatment of cases of this kind should be purely restorative; absolute rest is most important. The patient being laid flat should have belt and clothing loosened. Recourse may be had to stimulation externally by artificial heat applied to extremities, mus-

tard exhibited in some way over the precordial region; brisk rubbing with dry flannel, and hot bathing, if restoration is slow. Internally, the aromatic spirits of ammonia has a most salutary effect. Alcoholic stimulants may in some instances serve well. Morphine, digitalis, strophanthus, and strychnia may occasionally be required. They are best administered hypodermically. Recovery is usually rapid.

On one occasion, one September afternoon, in drill upon Boston Common, out of eighteen men in my regiment who suffered to the extent of either having to be helped from the ranks or falling from exhaustion, all but two were so far recovered as to be able to return to Camp Framingham, twenty miles away, the same night. In the typical sun-stroke premonitory symptoms are often wanting. The patient suddenly sinks into a profoundly relaxed and quiet state, or he may have great muscular restlessness, or even convulsions. The surface of the body is hot and usually dry, face flushed, eyes diffused with pupils variable, pulse rapid and apparently strong, vomiting is common, and in the more severe cases there is also purging, urinary secretion is scant, respiration is labored and irregular, unconsciousness is absolute, temperature markedly high, varying from 105 to 113° F.

For this class of cases most active treatment is required. A cool place must be found for the sufferer. His clothing should be removed, or at least well loosened and opened. Friction and cold upon the surface of the body are most essential. A stimulating impression upon the cutaneous nerves helps to re-establish a better respiration and circulation. For this purpose cold showering, or the cold water douche upon the chest, neck, and head is acknowledged by most authorities to be the best treatment. A thorough rubbing of the surface at the same time cold is applied aids greatly in bringing about desired results. Mustard applied to the spine and also rubbed over the surface of the body — dry — is believed by many a potent remedy. Convulsive conditions are best controlled by the use of chloroform. Cold fanning, immersions in cold water, and applications of ice are methods of treatment in common use.

Active treatment should be persistently enforced until signs of reaction appear, resulting in a lowering of the patient's temperature. Recovery is uncertain, nearly forty per cent of cases proving fatal.

Those surviving are often subject to a headache, which is almost constant, and intractable to treatment.

In review, text-book authorities in treating upon this subject disagree. Sun-stroke is not necessarily caused by the direct action of the sun's rays upon the body. The two conditions, heat exhaustion and sun-stroke, should not be confounded, as they differ essentially in symptomatology, prognosis, and treatment.

DUST, A SOURCE OF TYPHOID INFECTION IN THE MILITARY SERVICE.

AN ETIOLOGICAL ESSAY by MAJOR ALFRED C. GIRARD,
Surgeon, U. S. Army.

It has been my good fortune to make observations on the etiology of typhoid fever during an epidemic (which invaded the United States troops assembled in Chicago, during the riots of 1894), which, in a peculiar manner, establish a source of the disease generally unknown.

I believe I might justly call it a new source, since among all the literature at my command I find but two independent mentions of it, and these in a more or less indefinite way.

George B. Shattuck, in his article on typhoid fever in the Reference Handbook of Medical Sciences, states as follows: "There is no absolute proof that it (the typhoid fever poison) may not be suspended in a heavily charged atmosphere in such a way as to be swallowed with the air, and occasional cases would seem to demand such an explanation." Osler, in his Practice of Medicine, makes the following short mention of this source: "It may be also, as Baumgarten suggests, that in dry seasons the poison is more disseminated by the dust." This observation of Baumgarten is also mentioned in Pepper's Practice of Medicine.

The generally recognized modes of conveyance of the disease are direct transmission, infection of water, milk, and food supply, filth, sewer-gas, and ground-air. They will all be considered in connection with this epidemic, without regard to present views as to their correctness. The purpose of this paper is to show that they may be excluded, and that by exclusion — other data not being obtainable — dust infection must account for the epidemic.

At the outset I mentioned that it was my good fortune to make these observations, and it may well be called so. Incorrectness

usually results from an attempt of crowding cases occurring under dissimilar circumstances into a group, and attempting to draw deductions therefrom. Such a uniformity of age, sex, occupation, habits, climate, temperature, dwellings, and even vice, as will make etiological studies valuable, can only be found in the military service; and when we add to it the large numbers coming under observation at a certain given time, we may well call ourselves fortunate in obtaining such an addition to the knowledge of the source of a wide-spread disease.

A description of the organizations, their number, location, and similar important information, will have to precede their connection with our subject. A concentration of troops took place in Chicago early in July, 1894, on account of the railroad strikes. The first appearing on the scene were the 15th Infantry, two troops of the 7th Cavalry, and a light battery of artillery from Ft. Sheridan; total, 531 officers and men. On arrival in the city they proceeded as follows: The cavalry, artillery, and one company of infantry to the Stock-Yards; four companies of infantry to Blue Island, and three to Grand Crossing, both railroad centers on the outskirts of Chicago. About the 9th of July the cavalry and artillery were moved to the lake front, and the 15th Infantry camped at the various depots, railroad stations, and public buildings. About the same time there arrived from Ft. Leavenworth five companies of infantry, 265 men, and from Ft. Brady two companies with a total of 110, both detachments being scattered over the city, escorting railroad trains, guarding bridges and depots. A day later the 9th Infantry arrived from Madison Barracks, 390 strong, and three light batteries and four troops of the 3d Cavalry from Ft. Riley, with a total of 279. About the 10th four troops of the 6th Cavalry, a force of 200, reported from Ft. Niobrara. The 9th Infantry and the 3d Cavalry were camped at the south end of the lake front; adjoining them, to the north, the two troops of the 7th Cavalry, and then the light artillery. The first two organizations were on bare, newly made ground, the others on sodded soil. The 6th Cavalry were located on some vacant lots in Brighton Park, which, apparently, were filled in. The rest of the infantry were distributed as mentioned above. On July 19 all the troops, except the 3d Infantry, proceeded in two days' marches to Fort Sheridan, and all but the regular garrison went into

camp. The 3d Infantry returned by rail to their station, Madison Barracks. On August 14 the whole command moved from Ft. Sheridan to Evanston, Ill., a distance of twenty miles, for field maneuvers. The cavalry were camped on vacant lots in the town, while the artillery and infantry went into camp on a prairie south of the same. This camp was broken up on September 3, and the infantry belonging to Leavenworth and Brady returned to their stations; the 15th Infantry, the cavalry, and artillery to Ft. Sheridan. This somewhat lengthy description of the forces and their location was necessary for a correct appreciation of the sanitary history of the epidemic. During the stay in Chicago the health of the troops was good, with the exception of some diarrheal disorders, due to the great heat and the change of diet.

Typhoid fever first appeared on August 8, in a private of the 3d Cavalry, after a prodromal illness of several days, which, with the time of incubation, would carry the infection well within the Chicago period. Next came a private of the 7th Cavalry, then a corporal and a private of the 3d Cavalry within a day or two — results of the Chicago infection. Admissions during August 11, September 14, October 3 — total number of cases: 3d Cavalry (160 men), eleven; 6th Cavalry (200 men), five; 7th Cavalry (80 men), two; Leavenworth Battalion (265 men), one; Brady Battalion (104 men), two; 15th Infantry (380 men), seven; or, from a total of nine troops, eighteen cases (two per cent); while, from a total of twenty-three companies of infantry, ten cases (forty-two one-hundredths per cent). The 9th Infantry remained exempt, and no cases occurred in the regiment after its return to its station. The artillery had also no cases. Let us now consider the probability of infection by the usual sources.

1. *Direct transmission.* — The various posts from which the troops came were free from typhoid fever with the exception of Ft. Leavenworth, where isolated cases had occurred (its whole battalion had but one case). Madison Barracks, the station of the 3d Infantry, had a reputation for typhoid fever, until its water supply was changed within a year or two (no cases occurred in the regiment during the Chicago trip). Ft. Niobrara, where troops furnished the largest quota to the fever, had no typhoid. Ft. Sheridan was, up to that time, and since the epidemic, entirely free from the fever. That the epidemic found its origin in Chicago, and was not transmitted from other posts, can not be gainsaid.

2. *Infection of water.* — The health statistics of Chicago show that the prevalency of typhoid fever was less in July than any previous year for the same period, and in the wards in which the troops were camped, less than in other wards. A simple change of water, while it may affect the system, and may, therefore, lessen the power of resistance, will not convey typhoid fever without the presence of a specific poison. All the troops, those affected as well as those remaining exempt, used at Chicago the water from the city works, conveyed by pipes and hydrants. At Evanston lake water was used from the city hydrants. At Ft. Sheridan the same water was supplied from the post works. No typhoid fever had previously existed at the post, as mentioned above. The water supply as a source may, therefore, be negatived.

3. *Milk* may be excluded, as the troops were in three different localities when the infection occurred, and it can not be assumed that in all the milk was infected. It was, beside, not a regular article of diet.

4. *Food supply* was usually the regular ration, which had been used before and since the epidemic without ill consequences. Nearly all the food was cooked. As to fresh fruit, the same reasoning applies to it as to the milk supply.

5. *Sewers* need only be considered as a possible source at Ft. Sheridan, for the 15th Infantry; the endemic existence there of typhoid fever has already been disposed of in the negative. The camps in all three localities were provided with privy-pits, six feet deep, regularly disinfected with milk of lime, and filled in when the contents came within three feet of the surface.

The possibility of infection of the food supply by flies carrying microbes from the pits to the food has occurred to me, but the freedom of the 3d Infantry and the artillery renders this improbable.

6. *Ground-air* was, especially at the lake front, perceptible to the smell, and most so in the camps of the 3d Infantry and 3d Cavalry (which were on filled-in ground), so much so that the tents had to be kept open at night. But, again, the former being exempt, while the latter suffered out of all proportion, negatives the ground-air as a source.

7. *Filth.*—The camps were carefully policed, and the offal removed daily.

The usual sources having been disposed of, there remains the theory that the swallowing of infected *dust* will produce typhoid fever. In order to apply this to the present epidemic the following points are to be considered, viz.: The weather was very dry; the dust, especially at the lake front, very deep; the flies were torturing the horses, and in their efforts to fight off their tiny enemies they became covered with heavy layers of dust; the camps of the 3d Infantry and 3d Cavalry, at the lake front, were on filled-in ground, used by the numerous tramps who, homeless, look for a place safe from the police, as a sleeping ground and, of course, also for the wants of nature. The probability is that many of these tramps were sufferers from typhoid fever, and freely infected the soil. This dust the cavalry had to groom twice daily off their horses and, naturally, *swallowed* some of it. The infantry, camped on the same dust, did not suffer; the artillery on sodded, well-policed grounds, too near the street lamps to be the home of tramps, had less dust, and probably no infection.

At Evanston the cavalry was camped in city squares of doubtful soil, probably filled in to be sold as building lots, while the artillery and infantry were out of the city on prairie sod.

At Ft. Sheridan the infantry camped on sod, while cavalry and artillery were in clearings of the woods; the former, with their greater proportion of horses, soon pulverizing the soil, while the artillery picket lines seemed to be less affected in that manner. The infantry had enough dust to swallow on the various marches to account for even the small proportion of cases. It appears, therefore, probable, that if not all, at least the majority of the cases of typhoid in the epidemic originated in dust infection.

This is a question of great importance to military hygiene, where generally the ground for camps can be selected. Cholera has been known time and again to decimate commands who camped on old sites. Typhoid fever must now be considered another consequence of ill-chosen sites.

The lesson should not be lost for physicians in private life. Often they search in vain for a palpable cause for isolated cases of typhoid fever; the water and food may not be questionable; no defective sewers; no filth; no history of infection by transmission. Here the explanation by the dust theory may clear up the mystery.

Résumé.— A body of troops concentrated from six different stations is camped in three different places. In the first, at Chicago, part of the infantry (the 3d) and most of the cavalry (the 3d and 6th) occupy suspicious ground. Typhoid fever appears in the 3d cavalry (6.8 per cent), in the 6th cavalry (2.5 per cent), while the infantry, camped on the same suspicious ground, remain free, and the total of the infantry and light artillery show a percentage of infection of only .6 per cent. Direct transmission, infected water, milk, or food, sewer poisoning, ground-air, and filth have been excluded as a common cause. The only probability remaining is infection by dust; in camp for the cavalry, from grooming the horses (the dust in Chicago being probably infected by specific poison); on the march, the road dust for infantry, cavalry, and artillery.

The artillery remained immune, probably because at Chicago they were camped on clean, sodded ground; at Evanston, on the prairie, and at Ft. Sheridan, with fewer horses in proportion to the men, on better ground; with the additional possibility of absence of infection from former camps, which must be considered for the cavalry.

THE MERRIAM PACK.

BY MAJOR LEWIS BALCH, Surgeon, N. G. N. Y.

The question of how a soldier is to carry in the field extra clothing, food, blankets, and whatever else may be necessary to make him as comfortable as possible under the circumstances of a campaign, and yet not interfere with his efficiency as a fighting man, is one that has occupied the attention of military leaders for centuries. Man, made as he is, can but bear a certain amount of labor, and when to that we must, of necessity, add burdens, the minimum amount of weight with the maximum amount of ease in carrying and mobility of person, are the two considerations to be chiefly taken into account. Comfort, as looked at in the ordinary meaning of the word, does not have so much weight in the problem, but the more of this factor we can secure, the more cheerfully will hardship be borne when inevitable, for the soldier quickly knows and fully appreciates the fact that his comfort and well-being are cared for by his officers, and *visa versa*.

As medical men, we can and do approach this subject in a different light than do officers of the line, for we primarily look at the physical effect of weight imposed, and reason rather as doctors than as officers. Study shows us, however, that we must aid with our knowledge of the physical necessities the requirements of line officers for the working ability of their men, and so endeavor to make our soldiers not only comfortable but efficient.

Anatomy teaches us that man is made to walk erect. Anything, therefore, which tends to pull or push him from this natural position, the normal one in which muscular effort is saved by gravitation, is to be avoided in the arrangement of a pack. The ideal method of weight-carrying is to place the burden upon the head. Here the weight is, the person being erect, transmitted through the strongest line of bone to the ground, and no pressure in any way is brought

upon the contents of the chest or abdominal cavities. To see men and women in southern countries carrying burdens on the head, the hands swinging and the walk free, is well worth the seeing as an exemplification of the perfect bearing of the human frame. But, naturally, this method is barred to the soldier, and we resort, then, to the shoulders. Could the burden be put here in such a way as to press equally on both shoulders, and in a direct downward line, we would also have the freedom noticed when the head is the point of rest, but the burden would not be so easily borne; for, if as much pressure was given the shoulders as can be withstood on the head, pain would become a factor, and not one to be ignored. In addition to the shoulders, we have the hips as a weight-bearing surface, if we can so place the weight that it can be carried without undue constriction of the waist or interference with the motion of the thighs. These, the shoulders and the hips, are the two points, anatomically speaking, where we can place weight and have it easily carried. To do this has not been found so easy as it at first appears.

Man can carry a heavy load on his shoulders and back, he bending the body forward while so doing. But this position can not be for long. He carries the weight at the expense of his heart and lungs, for the greater the burden and the angle at which he inclines the body the more strain must be put on the heart to perform its functions, and the less able he is to inflate the lungs and properly aerate the blood. And, in like manner, when the weight is not great, but is borne by the back and shoulders, steadied by some counter-weight or breast-straps, the heart and lungs are interfered with to a less degree, I grant, but still experience shows to a degree sufficient to interfere with the proper working of these organs, and, as a result, we have our man more quickly tired and rendered ineffective than were he free to move and bear himself as nature ordained. The principle applies to dress as well as the knapsack. You all remember the old story of the trooper's answer when asked if he had to fight another Waterloo what uniform he would prefer: "Please, your Majesty, I'd rather fight in my shirt-sleeves." The object to seek, then, in a pack for a soldier, is one capable of carrying all he needs, easy to put on and off, readily maintained in position when worn, distributing the weight to the weight-bearing surfaces at command, and not interfering with the movements of the chest walls, or of the body in general.

How the soldier in ancient days carried his necessaries, or whether he carried any, is a question I can not answer. From general histories of early wars, up to the time of Napoleon, the inference is drawn that changes of clothes and many other articles were procured by the soldiery in the simplest of fashions, viz.: by helping themselves from the private stock of such as were unlucky enough to be near at hand. It does not affect us, however, if they carried packs or not. The old order has changed for the new in this as well as other essentials of military equipment. Our interest lies in the present, and with the accouterments of the civilized armies of to-day. It is our duty, as medical officers, to seek that form of pack which, while meeting all the requirements of personal luggage, gives the least annoyance to the wearer and the least injurious pressure upon the body. I wish to acknowledge my obligation to Gen. H. C. Merriam, Colonel of the 7th Infantry, U. S. Army, to whom I am indebted for copies of his exhaustive and excellent report to the Adjutant-General, on the "Foot Soldier's Kit, and How to Carry It," and for the reports of other officers who have examined and tested the Merriam Pack. Gen. Merriam's report is so full and clear upon the subject it treats of, that I do not hesitate to quote largely from it, for he states, far better than I can, many of the points which govern in the study of the foot soldier's outfit.

The General says: "The conditions under which soldiers go into the field have been constantly changing with the improvements made in implements of war, and in the means of transportation of supplies. * * * His support and shelter require no less food and clothing, while his efficiency requires a heavier armament and more rapid and extended evolutions."

Looking at the English and German requirements in an infantry man's outfit, the General states the English field kit to weigh thirty pounds and fifteen ounces. To this should be added a haversack (empty), water-bottle (filled), and three days' rations, which bring up the weight, independent of arms and ammunition, to a total of forty pounds. It should be said this includes ten pounds allowed for the clothes worn, and if the armament be added with sixty cartridges, we have the entire weight carried by the man as fifty-six pounds and eight ounces. Of late years some slight modifications have been made in this kit, which would lighten it about a pound and

a half, but as the enumeration does not include a blanket or shelter-tent, an intrenching tool, and extra ammunition, the total weight is below that actually carried when these extras are added. With them the burden reaches sixty-three pounds.

In Germany, while the weight of the kit was found in the war of 1866 to be objectionable, no change was made until after the war of 1871, when a service outfit was established in 1877, with an aggregate weight of seventy-four pounds thirteen and a-half ounces. Further experimentation reduced this to that of the kit now in use, which is about sixty-three pounds fourteen and a half ounces.

To quote again from Gen. Merriam, we find the "Russian infantry men carry seventy and a half pounds, the Austrian sixty pounds, the Italian seventy-five pounds; * * * but these weights do not include the increased supply of ammunition conceded to be necessary for troops going into action with repeating rifles." In our own service for the field he recommends an outfit not to exceed forty-one pounds ten ounces, and a "surplus kit to be carried in the regimental wagons, unless otherwise provided for in the marching order," of twenty pounds two and a half ounces. This may be reduced somewhat in weight in the discretion of the commanding officer and additions made in the same manner, but the extreme limit of the service kit is put at sixty-three pounds ten ounces, including rations and extra ammunition.

It appears, then, that for service, taking into consideration the clothing worn by the soldier, his arms, ammunition, rations, and effects, a weight of between sixty and sixty-five pounds will, at times, have to be carried, and the important question of how this is to be done, so as not to impair the man's efficiency and to conserve the functional activity of the vital organs, has been well solved in the Merriam Pack. To understand its advantages, your attention is asked to the descriptions of the English and German outfits. Dr. Francois de Chaumont, Professor of Military Hygiene in the Army Medical School of Great Britain, describes the English valise equipment as follows:

> This equipment is very easy, and leaves the chest perfectly free; it is simple, both in principle and construction, and affords many facilities for the carriage of articles, such as the haversack, water-bottle, blanket, etc., which prove useful on service. It is of more importance to note here that it cer-

tainly assures all medical requirements, and as it leaves the man free and unincumbered in his movements, it does away entirely with the stiff, unmilitary appearance produced by the old plan. There seems only one sanitary point which has been urged against this equipment, and that is that a good deal of the back is covered, and that perspiration collects under the valise. Whatever equipment be used, there must be retention and perspiration under the covered parts; this is inevitable, and is produced by any knapsack. The valise equipment is no exception to the rule, but it is singular how little perspiration collects under the valise if the man knows how to manage it. By allowing the top of the valise to fall back half an inch a space is left between the greater part of the valise and back, which allows evaporation, and the loins are kept cool. On the march also, when the waist-belt is unbuckled, both valise and great-coat hang loosely and away from the body, and evaporation goes on. The principle of the valise equipment will probably always be maintained, although some details may be altered.

If we examine the bearings of the equipment, it is seen the weight is suspended from the shoulders, the balance method being employed by placing the cartridges in the pouches in front; and, unless the soldier lean forward, the hips do not carry any of the weight. But the most objectionable feature is the diagonal strap over the chest; for, as enough ammunition is not carried to perfectly balance the weight of the pack, something is required to help keep it in position, and nothing answers except to practically tie it on with a breast-strap.

The German knapsack. Here the whole outfit is suspended from the shoulders, the waist-belt being fastened, with its burdens, to the pack. A cross-belt is necessary to hold the pack in position.

In our own Army the blanket-bag was, in 1887, made the infantry pack. Gen. Merriam, in his report, says of it: "It is no better, in fact, many old soldiers pronounce it worse, than the painted knapsack of ante-war days. In this equipment no attempt is made to utilize the cartridge-boxes or belt to assist in balancing weights over the shoulders; hence, the pernicious diagonal strap is left its full power for cutting and constricting the axillary vessels and nerves. It is most awkward and inconvenient to pack; in fact, it is almost impossible to pack it according to regulations, as a full service blanket can not be got into it without the greatest difficulty."

In Gen. Merriam's regiment the haversack, with underclothes and small articles, is put inside the blanket-bag, while the blanket, with shelter-tent and poles placed in the ends, is made into a roll and fastened around the pack by the guy and coat-straps. The canteen and cup are then hung outside.

In all of these equipments some constriction is caused to the chest, and the pack, of necessity, lies close to the body, increasing perspiration and discomfort. But a different state of affairs prevails when we examine the Merriam Pack. The weight is here borne by the shoulders and hips; no pressure by cross-belts is on the chest walls; the pack is clear of the body; it can be shifted at will so as to ease pressure, at one time giving more to the shoulders, at another more to the hips. There is no haversack banging about the legs, and sometimes, if the accouterments are loose, swinging between them; rations, extra ammunition, clothes, and small articles are in the pack; the blanket, shelter-tent, poles, canteen, and overcoat are easily got at, for they are outside, and, from experience, I can say it does not impede the wearer's movements, no matter what he wishes to do.

In 1893, while at the Camp of Instruction at Peekskill, N. Y., by direction of the late Major-Gen. Porter, Adjutant-General of the State, I made some tests with the pack. These consisted in taking a party of four men and marching them across country for seven miles, each wearing a pack weighted to about twenty pounds, and armed, but carrying no ammunition. The first experiment was on July 9, 1893, the party marching out of camp about two o'clock in the afternoon, with a temperature between 75° and 78° F. The route led over cultivated land into young wood with heavy underbrush, across fences, walls, and streams, up hill and down, ending with the highway. At times the men had to crawl under obstructions. When camp was cleared coats were opened, waist-belts undone and hooked to the waist-belt straps of the pack, arms were carried at will, and the men encouraged to smoke, talk, or do anything they pleased. When the party returned to camp I took a statement from each man, and I quote what was said from my report:

"Sergeant Bailey (Company C, 10th Battalion) had served two enlistments in the Army, one in the 21st and one in the 8th Regiment of infantry. While in the latter he was of the expedition under Gen. Miles which brought in Geronimo. He had carried the canvas and leather knapsack used in the regular service, the blanket-bag, blanket-roll, and since his enlistment in the Guard its knapsack. He stated, after his trial of the Merriam Pack, it was 'the best pack he ever tried. It was comfortable, weight was distributed

well, and the outfit was comfortable. The absence of straps across the chest, and being able to open the coat and belt, was a great advantage.'

"Sergeant Hoag had served eighteen years in the 12th Regiment, N. Y., and all in the same company. He had stated to Lieut. Hardin, in the morning, he was opposed to the pack, and that he would rather have the knapsack used by the Guard in 1876, the one before the present issue, but on personal application he was willing to make the trial. He said: 'If I had my way I would adopt it—but, of course, I could not have that—because it's easy in every way. It does not shift its position once on, and no matter what position I am in it stays there, and is easy to carry. It's a great thing to throw open the coat, as it makes it cooler, and there are no straps to bother a man's breathing.'

"Private Hooghkeck (Company C, 10th Battalion) served in the 9th N. Y. Heavy Artillery Volunteers for three years in the War of the Rebellion, being in the Army of the Potomac, and also in the Shenandoah Valley. He had carried the old army bag and square knapsack, also the knapsack issued by the Guard. Hooghkeck said: 'I think this is the finest and best pack I have ever seen carried, for comfort and ease. The best I have ever seen, carried up hill and down, over fences and ditches.'

"Private Menken (12th Regiment) has been eighteen months in the Guard. When a boy of thirteen and a half and up to fifteen years he was a cadet in the 75th Infantry Corps, Bremen, Germany, and had to take part in the Summer maneuvers. Had to carry a knapsack similar to the Regular German Army issue, only smaller and lighter, but it weighed, with his things, thirty-five pounds. He has, since enlisted in the 12th, carried the Guard knapsack at Buffalo, and also in this tour. He said: 'I say the same thing about the pack as Sergeant Hoag. I consider it the best, so far, I have had to carry.'

In the last week of the tour of duty at the State camp in 1893, a detachment under Major Cochrane, 13th Regiment, consisting of volunteers from his command, marched from New York to Peekskill, for the purpose of testing the Merriam Pack. Shortly after their arrival in camp, in acccordance with instructions received from Gen. Porter, in company with Capt. Hardin, of the 7th U. S. Infantry,

then serving with us, I examined five men who complained they were chafed by the pack, and I quote that part of my report that bears upon this point:

It appears that the slight reddening, or what was said to be chafing from the hip-bearing straps, was caused by improper adjustment of the pack, allowing the knapsack to swing more or less, and so cause an uneven movement of the weight-bearing straps. In no case was this rubbing of sufficient importance to be called chafe; nor was it more than what is often seen from the creases of clothing when one is taking a prolonged march or exercise. The maladjustment of the packs, due to the men not paying proper attention to the instructions given them, and from statements made also by the men in relation of bayonet-scabbards to stick-sockets, does not prove that the pack, properly adjusted, is not a good contrivance for the carrying of weight. It should be noted that there are five men out of sixty who had made the march, and of these five men but one had the pack proper in all respects as to its adjustment, two were improperly tied, and one had uneven straps."

It is, of course, impossible to get any outfit which, if worn improperly, will not be found uncomfortable or inadequate. One of the men in the detachment carried the English-valise equipment, and he told me he did not like it — it was hot, and the breast-strap was more or less confining.

In September, 1894, Company B, of the 10th battalion, took a practice march of three days. The men carried the Merriam Pack, arms, and equipments, but no rations or ammunition. No cases of chafe reported, and the men, when halting for a rest, did not seek a bank or rail on which they could rest their packs. On the third day an exercise in minor tactics was engaged in, consisting of a small defending force, and the main body as the enemy. Scouts were detached from the defenders and sent to find the enemy, as he was known to be advancing on one or two roads. To obtain a greater view two of the scouts climbed a large pine tree, and, in their interest in the work they were engaged in, forgot they had their packs on, but climbed with them on their backs.

The Merriam Pack has been adopted for the Guard of New York. For the service our troops are called on to perform I believe no better or more convenient form of pack could be devised; for, in cases of active duty, being chiefly stationed in cities, rations do not have to be carried by the men, and the ordinary cartridge-box holds all the ammunition necessary. This, consequently, leaves greater room

in the pack for the soldier to put in articles for his comfort. And if we should be ordered on the march, the readiness with which the men get accustomed to carrying the pack is a proof of its being constructed on scientific and hygienic principles.

As said before, I believe Gen. Merriam has solved the problem of how to carry a soldier's kit, and a more extended trial will but confirm the good reports received from wherever the outfit is used, that the knapsack for the infantry-man is the Merriam Pack.

A CONSIDERATION OF SCORBUTIC MANIFESTATIONS IN THE YOUNG SUBJECT.

BY JOHN C. WISE, M. D., Surgeon, U. S. N.

It may be deemed that a subject such as this is hardly appropriate for "The Association of Military Surgeons," yet its interest, from a pathological point of view, makes it well worth our consideration.

While scorbutus has declined in importance as a disease incident to sea life and to armies, it would seem that changing physiological and economic conditions may cause it to be dreaded on land, as it has hitherto been on the sea. A most interesting feature in this connection is the close resemblance of this disease, as seen in the young, to rachitis, and there can be no doubt but that in the past many cases of scorbutus have been considered and treated as cases of rachitis. Scorbutus can not only become engrafted on a rachitic stock, but the agencies of these diseases are not remote, both arising from deprivation of those proximate principles and elements requisite to normal histogenesis. Furthermore, the clinical histories of these maladies can be paralleled, and until recent years German writers have insisted that the so-called "Infantile Scorbutus" was but acute rachitis. This contention was undoubtedly founded on insufficient "post-mortem" evidence, and is no longer held. What made this view more plausible is a fact before noted, that the scorbutic condition is so often engrafted on rachitic stock that we have the same decided bone symptoms and the same pseudo-paralysis in both diseases.

Let us review the history of the differentiation of these maladies. Twenty-two years ago Ingerslev, a Swedish physician, pointed out this disease, similar, in some respects, yet radically different from rachitis. At this time the Germans based the non-existence of scrobutus in infants on the fact that no sponginess of the gums had

been discovered; in 1880 Dr. Kuhn reported an epidemic of scorbutus at Moningen; thirteen cases were recorded of infants suckled by mothers who were at the time scorbutic. Huebner, of Leipsic, and Rhein, of Frankfort, made able researches in this direction. The subject was taken up in America, first, by Northrup, in 1891. Starr, Holt, and others reported 111 cases to the New York Academy of Medicine. In Dr. Northrup's cases four post-mortems are reported.

In England, Cherdle, in 1879, confirmed the observations of Ingerslev, and definitely fixed the place of this disease, and while there have been many workers in that country, it remained to Prof. Barlow to establish the most important "post-mortem" appearances in an extensive series of cases, confirming the work already done by Dr. Northrup in this country. The protean feature of this disease is hemorrhage. Spoliation of the blood is carried to such an extent that hydraemia is established, involving effusions into most of the organic tissues, the favorite seat being sub-periosteal, and it is these conditions, so essential to the scorbutic state, which have established the identity of the disease. Thus, while hemorrhage beneath the periosteum is the usual seat it has also been reported as occurring in the nose, intestine, urine, muscles, medulla of the bones, pleura, spleen, and gums. In Prof. Barlow's cases a sheath of blood was found about the femur, and serous extravasation in the femoral muscles, with blood-clots in some instances; the same changes were observed in the tibiæ and scapulæ; the humeri showed spongioid ossification, with extensive medullary hemorrhage. In the ribs the periosteum was detached, and a chocolate-colored debris was found between it and the bone. The joints are not the seat of hemorrhage, and the visceral extravasations are slight. Under the microscope it was found that the trabecular structure of the bone was, in a great measure, absorbed, and it may be here noted that the minute pathology of scorbutus, as observed by Bristow, is at variance with that of rachitis as studied by Virchow and Kolliker.

Scorbutus attacks infants, as a rule, before the end of the first year of life. We notice, as to flesh, no great loss, but the pallor is extreme, marked by muddiness of the skin later; the little patient, hitherto mentally active, becomes apathetic or irritable, muscular activity ceases, the lower limbs being flexed, while effort to extend them causes piteous cries of pain. Swelling of the limbs soon

follows, usually symmetrical; at first undecided, it progresses to deformity. The favorite seats of this symptom are the wrists, the epiphyseal junctions of the ankles and the thighs, the swelling at the ankles extending upon and involving the tibiæ to a greater or less extent. When held in the lap the limbs hang in a helpless fashion, with feet everted, very suggestive of paralysis. The infant no longer sits, but reclines, and if it has been walking it now refuses to do so. An intense irritability of the affected parts exists, the patient suffering intensely, due doubtless to two causes, pressure on the nerves and anemia.

In cases somewhat advanced a characteristic occurrence is hemorrhage into the orbit; if not aware of the true nature of the disease, we are apt to believe we are dealing with a catarrhal condition; the lids swell, but there is little discharge, and there is no relief from treatment usually successful. Some ecchymosis of the lids is noted and the eye looks protuberant, which is in reality the case, being displaced by hemorrhage beneath the orbital periosteum. This displacement is an obstinate condition, and exists in a case under the writers care, four months after disappearance of other symptoms. If dentition is in progress it is delayed, or the teeth are black and corrugated on eruption. The gums are very vascular, and bleed easily; soon sponginess is marked and fleshy growths protrude about the erupting teeth; sometimes the teeth are covered in by the swollen gum as if by a hood, all of which is accompanied by a most fetid condition of the breath. The digestive symptoms are markedly in contrast with those of rachitis. The appetite is good, an effort apparently to repay in quantity what is lacked in quality. Diarrhea does not exist, as in rachitis, unless cod-liver oil is being given, and even then it may be absent, the oil only serving by its malassimilation to give a foul odor to the alvine discharges. The urine is diminished, has a strong odor, is sometimes albuminous; hematuria, though noticed in some cases, is not a common symptom.

The temperature is elevated from 1 to 25°, and has slight diurnal variations. A prominent symptom is sweating of the head, just as we have in rachitis. If, after the lapse of a month or two the true nature of the case is not determined and appropriate treatment instituted, emaciation sets in and we detect the osseous swelling about the femur and tibia more distinctly. If, on the other hand,

the disease is to give way to improved diet and treatment, the subsidence of swelling at once commences and progresses rapidly; the bony formations are absorbed, deformity disappears, and motion is slowly restored. The condition under which scorbutus and rachitis arise is instructive. From time immemorial, and with etiological accuracy, rachitis has been looked upon as a disease of the poor, the illy fed, clad, and housed. Scorbutus in the young, on the other hand, is found in the homes of the affluent oftener than in those of the indigent. This is due, in greatest measure, to the extensive use of proprietary foods among the better classes; being beyond the reach of the poor, they indulge their infants, and thus secure for them much that is essential to normal growth.

While we are aware of the conditions which produce rachitis and scorbutus, we are still ignorant of what is lacking in a dietary to produce either; it is neither citric, nor malic, nor tartaric acid, nor the alkaline bases, nor yet their combination; but we know that these substances abound in the juice of oranges, lemons, and fresh vegetables. The exact cause is still a question awaiting solution by biologic chemistry. Garrod has demonstrated a deficient alkalinity in scorbutic blood, and we know that malates, tartrates, and citrates are convertible in the blood into alkaline carbonates. Beyond all this there lies histogentic changes which we do not comprehend, but the fact remains that the nearer we approach nature's formulæ the safer is the diet for the young. Uncooked meats and milk are more antiscorbutic than when cooked. While infantile scorbutus has been noticed in children at the breast, these cases are reported from abroad, where the dietary of the lower classes is so often deficient. In the vast majority of cases the infant has been deprived of its natural aliment—breast milk—and some of the proprietary foods have been substituted. We know that however closely these preparations approach the analysis of human milk, and however plausible their claims on theoretical grounds, as a true physiological dietary, practically, they are failures. The infant's food is a natural product, and if it must be changed, we naturally would substitute the milk of some mammalian, and thus the best substitute for human milk is cow's milk.

Briefly, in conclusion, let me call attention to the practical therapeutic benefit to be derived from the researches in this field of the

names which have been mentioned. To those doubting the differentiation of these diseases—that is, scorbutus and rachitis—treatment might be to them in the light of a control experiment. If, in a case such as we have attempted, rather generally, to describe, and which has probably been treated as rachitis, we dispense with the chalybeate and calcic syrups, which, after all, are but adjuncts to a proper diet; if we use pure cow's milk, sparingly diluted with lime water, and scalded (this much we must concede to sterilization); if we permit some article of the much-abused starch group in the dietary, preferably baked potato, finely sieved, and last, but not least, if we allow orange juice, not by the teaspoonful, but sweet oranges, we might say, *ad libitum;* if these things be done, a change most gratifying will be at once manifested. In the writer's cases it has been the most complete he has ever known in medicine. As to cod-liver oil, it may or may not be superadded; a good criterion will be to watch the bowels in reference to its assimilation. As a rule, it is unnecessary.

REMARKS UPON THE PROPER FORM AND THE ADVANTAGES OF A DIAGNOSIS TAG FOR USE AMONG THE SICK AND WOUNDED ON THE BATTLE-FIELD.

By W. H. Forwood,

Lieutenant-Colonel, Deputy Surgeon-General, U. S. A.

Among the many details to be considered in preparing troops for active service, there are two that relate to tags, which may be of considerable value in time of conflict. One is the diagnosis tag, to aid the medical officers and their assistants in classifying and handling the wounded on the field, and the other is the identification tag, which concerns all men in the Army exposed to danger, as a means to prevent losing the identity of those who are killed.

During the War of the Rebellion, where neither of these tags were used, thousands of brave men fell in battle and their bodies lay on the field without sufficient marks of identification, and were consigned to burial among the "unknown." The painful evidence of this fact is now to be seen in the long lines of marble posts that mark the nameless tombs in all our national cemeteries. But who will attempt to depict the secondary consequences of such neglect upon the thousands of relatives and friends who were left to mourn the loss of those whose real fate they could never learn, and on whose individual graves in after years they could lay no floral tribute to the dead. It may reasonably be assumed that no civilized nation will again subject its soldiery to such a melancholy fate as this, nor its people to such unnecessary sorrow, and that in future our own troops, like those of many Europeon powers, will be supplied with identification tags, or with some similar indispensable device, that their bodies may, in case of need, be recognized after death. For this purpose every officer and every enlisted man in the military or naval service, on going into battle, should be provided with a small

metallic tag to be worn about the neck, next the skin, with his full name, date and place of birth, and the command to which the wearer belongs engraved upon it.

But, in addition to this, it has been found by experience in war that a diagnosis tag is also very necessary and convenient in the management of the sick and wounded on the battle-field between the firing line and the field hospitals. Such a tag is needed, and may be used for the following purposes:

1. For aiding in the classification of the sick and wounded into groups, according to the nature and gravity of their diseases and injuries, so as to facilitate the handling of them by the Hospital Corps men who come to remove them from the front. Three classes usually are sufficient, and these may be conveniently designated by the three colors, red, white, and blue, combined on one tag. Red designates a soldier unable to endure transportation, who must be temporarily provided for at or near where he lies; blue, that transportation is required; and white, that the soldier is able, if need be, to walk to the dressing station or hospital. It is important that these main facts should thus be indicated by conspicuous colors, so as to save time and the necessity for a closer inspection of the tags under circumstances where the chief object is to hasten the speedy removal of the disabled away to the rear out of the line of fire.

2. For giving a diagnosis as definite as possible of the nature and urgency of his disease or injury, to save the soldier the pain and danger of repeated examinations by the many surgeons and attendants into whose hands he may afterward happen to pass.

3. For recording such treatment as may be administered from time to time at the front, or on the way to hospital, and for indicating the need of other measures, if any, which the surgeon at the front is not prepared to carry out, and the urgency of the case.

In preparing a diagnosis tag it is necessary to consider what useful purposes may be accomplished by it, and to adapt it only to those which are essential and practical. It is to be regarded, in the first place, as a mere temporary device to fulfill a temporary purpose, not to be kept as a permanent record, but thrown away the moment a necessity for its use ceases to exist. It is no purpose of the diagnosis tag to record the name, rank, company, or regiment of the soldier to whom it is attached. While the sick and wounded are

being collected from the firing line and hurried back to places of safety and on toward the dressing stations and field hospitals, it can make no possible difference what their names are, and their rank and command will always be recognized by the uniform they wear. But should it be necessary at this time to know the name of any particular soldier, and he be unable to speak for himself, it may be found correctly recorded on the identification tag about his neck. No one need take the time or trouble to record such data during the pressure of far more important duties and responsibilities. When a place of safety has been reached, where the sick and wounded may remain for a time under treatment, a list of their names can be made at leisure, and then the diagnosis tag may be dropped. But even if it were possible to do so, the entry of every man's name, rank, company, and regiment on the diagnosis tag would be worse than useless, for the vast number of errors thus inevitably collected would pass from these tags into the permanent records of hospitals, and introduce in this way an element of confusion which must spread and accumulate, until eventually the entire medical and surgical statistics of the war were vitiated by it.

In attempting to construct a good, practical, and convenient form of diagnosis tag, we must bear in mind all the conditions and circumstances under which it is to be used, and the exact purposes to which it is to be applied. One must go, in imagination, upon the field where the battle is in progress, with the wounded lying about him, in order to fully understand what the real uses of a diagnosis tag are, and to appreciate what can and what can not be accomplished by it. It may, indeed, be made to fulfill a most important purpose, both for the convenience of the surgeon and for the benefit of the sick, but its sphere of usefulness is bounded by certain limits which we dare not exceed. As little writing as possible should be required of those who make entries on the tags. There is but little time or convenience for such work on the field. During, and immediately after great battles, precisely when a diagnosis tag is most needed, the attention of medical officers is taxed to its utmost limit, and we should avoid imposing upon them then any additional burden of clerical work which is not absolutely necessary.

The use of a stub for retaining a duplicate of the entries on the diagnosis tag, recommended by several medical officers, which would

double the amount of writing and reduce the space to one-half, is not only unnecessary and impracticable, but it is quite impossible from the very purpose for which the tag is used. The entries can not always be made in full, nor even in part, by the one who attaches it to the soldier and retains the stub. The tag is to be attached to every sick and wounded man as soon as possible after he becomes disabled, and this may be done by a medical officer, a member of the Hospital Corps, or by a company bearer, but the diagnosis must, as a rule, be made by a *surgeon*, and other records of the administration of medicines and stimulants, and the application of dressings and appliances, may be entered on the tag from time to time by numerous others all along the route between the firing line and the field hospitals.

Numbering the tags, as proposed by some, is likewise unnecessary and impracticable. They are given out from different points by different parties, and no consecutive series of numbers can, therefore, be maintained among them, but the total number distributed by any party may always be known. The diagnosis tag, issued from the Surgeon-General's Office, edition of 1895, appears well suited to its purpose, and capable of fulfilling it about as completely as any such device can be made to do. It consists of a card with a red and blue border, and a white space between, ruled for recording the diagnosis on one side and the treatment on the other. The form is plain and uncomplicated; the writing is reduced to the minimum, while the space is ample and the entry of records is further facilitated by the introduction of a few simple characters of abbreviation. The blue border is to be torn off and the red left on, when, from shock, hemorrhage, severe injury, or other cause, the soldier is, at the time, unable to endure transportation. The red border is to be torn off and the blue left on when the soldier requires transportation and can be moved. Both borders are torn off and the white only left when the soldier's disability is slight, or such that he can walk to the dressing station or hospital. Under *diagnosis* the medical officer is to give a brief and intelligible description of the seat and character of the injury or the nature of the disease and sign it, and under the head of *treatment* is to be recorded what is administered and what is done from time to time by medical officers or their assistants, and, when proper, it may be indicated what further is

needed, and the urgency of the case. When anodynes or stimulants are given, the hour and quantity are to be accurately noted. The tags are bound in book form, with directions printed on the cover, and punched at the end for the insertion of linen cord, light copper wire, pin hooks, or other means of attachment to the clothing. Each book contains a few *emergency tags* for use in special cases.

For purposes of instruction and practice at the Hospital-Corps drills in time of peace, the diagnosis tags may be made of cheap material and binding, but for actual service in the field the paper should be of a quality to withstand the rain, and tough enough not to tear out at the eyelet holes, and at the same time suitable for writing with a pencil, which should then be provided with each book.

OUTLINES OF THE SANITARY ORGANIZATION OF SOME OTHER OF THE GREAT ARMIES OF THE WORLD.

BY MAJOR JOHN VAN RENSSELAER HOFF,
Surgeon, U. S. Army.

VI. THE ARMY OF SWITZERLAND.
VII. THE ARMY OF ITALY.
VIII. THE ARMY OF RUSSIA.

I have heretofore defined military sanitation as the art of preserving the health of soldiers. It is an extremely comprehensive art, for it includes, not only military medicine and surgery, but everything which pertains to the prevention and cure of disease and injury under the peculiar and varied conditions of military life; and it demands of its followers, besides a knowledge of scientific questions of treatment, *a very exact military training and execution.*

One of the most important subdivisions of this great subject is *organization*, and yet I venture to say that during almost this entire generation no professional subject has attracted less attention in our country than has military sanitary organization, and consequently none is less understood. With the view to a more general dissemination of a knowledge of this subject, I will invite your attention, in continuation of my paper presented at the last meeting of this Association, to the sanitary organization of

VI. THE ARMY OF SWITZERLAND.*

The Federal Council, the highest military authority, controls the War Department, which, for convenience of administration, is subdivided, much like our own, into bureaus. The head of one of these,

* Information upon the subject of this paper has been sought from convenient sources, and the compiler has equally freely used the substance and the words of the various original reports, etc., from which he has gleaned. He is particularly indebted to the Military Information Division of the Adjutant-General's Office, U. S. A., for valuable assistance.

the Medical Department, is the Chief Medical Officer, a Colonel, who directs the entire sanitary service of the Army in time of peace, including the recruitment, instruction, and discipline of the sanitary (H. C.) Corps, and the control of all the material of his department. In his office are an assistant (Chief de Bureau), a secretary, and a clerk; and he is also assisted by a staff-apothecary officer (Major) in matters connected with medical supplies. In time of war, a chief of the hospital service, a chief of the voluntary sanitary service, and an apothecary officer are added to his staff.

There is also, in active service, a principal medical officer, who is the immediate head of the sanitary service in the field, eight field hospitals ("Elite"), sixteen ambulance hospitals ("Landwehr"), five transport columns, three sanitary railway trains ("Landwehr"), and eight hospital sections ("Landwehr"), may be mobilized. The various arms of the service take precedence among themselves in the following order: Infantry, Cavalry, Artillery, Engineers, Sanitary troops, and Administration troops. In the Swiss Army all officers of the various departments, except Chaplains, hold actual military rank, and are addressed by their military titles. The rank of medical officers ranges from First Lieutenant to Colonel; those of Apothecary-officers from Lieutenant to Major.

SANITARY TROOPS.

Establishment of a Field Hospital.

- 1 Medical officer commanding (Major).
- 1 Administration medical officer (Captain or Lieutenant).
- 1 Apothecary officer (Captain or Lieutenant).
- 1 Chaplain (sometimes two).
- 1 Clerk (Lance-Corporal).
- 1 Attendant (N. C. officer).

Attached from Second Division "Landwehr" Train Battalion.

- 1 Captain.
- 1 Lieutenant.
- 1 Veterinary officer.
- 1 Sergeant-Major.
- 1 Quartermaster-Sergeant.
- 9 Lance-Corporals.
- 2 Trumpeters.
- 1 Wheelwright.
- 2 Collar-makers.
- 2 Farriers.

COLUMN OF CARRIAGES.

12 Requisitioned carriages for wounded (24 draught-horses).
2 Requisitioned carriages for provisions (4 draught-horses).
2 Requisitioned carriages for baggage (4 draught-horses).
2 Material wagons — "Fourgons" — (8 draught-horses.)
35 men, 7 saddle-horses, and 36 draught-horses (of which 16 are spare horses).

Establishment of an Ambulance (Hospital).

1 Chief of Ambulance (Captain).
3 Other medical officers (Captains or First Lieutenants, three as a minimum).
1 Quartermaster (First Lieutenant or Lieutenant).
1 Apothecary officer (First Lieutenant or Lieutenant).
2 Hospital attendants (N. C. officers).
10 Hospital attendants (Lance-Corporals).
2–4 Bearers (N. C. officers).
20–24 Bearers.
1 Fourgon (material wagon, four draught-horses).
1 Ambulance wagon for wounded (two draught-horses).
1 Provision wagon (two draught-horses).
1 Baggage wagon (two draught-horses).

Mountain ambulances will be formed, as required, from the personnel of the regular ambulances, and equipped from the field hospitals. The equipment for two mountain ambulances is permanently kept up for the 8th Army Division.

To the sanitary troops of the "Landwehr" is assigned the duty of organizing any necessary number of ambulances; there are at present sixteen in this branch of the national forces. The transportation (wheeled) for these ambulances will probably be requisitioned. The sanitary personnel, not thus employed, will be distributed among the hospitals and transport columns, etc., mentioned below.

The field hospitals are numbered 1 to 8, according to the divisions to which they belong. The ambulances of the "Elite" are numbered 1 to 40, Nos. 1 to 5 belonging to the first field hospital, and so on. Those of the "Landwehr" are numbered 1, 2; 6, 7; 11, 12; 16, 17; 21, 22; 26, 27; 31, 32; 36, 37; Nos. 1 and 2 belonging to the first divisional district, 6 and 7 to the second, and so on.

THE SANITARY RESERVE OF THE ARMY.

For the transport and care of the sick and wounded sent from the front during military operations, the following establishments will be furnished by the "Landwehr" of the whole army:

5 Transport columns.
3 Sanitary trains (Railway).
8 Hospital sections.

The transport columns are intended to co-operate with the railways and steamboats for conveying the sick and wounded from the field hospitals to permanent institutions.

Establishment of a Transport Column of the Sanitary Reserve.

1 Principal medical officer (Captain].
1 Medical officer (Captain or First Lieutenant).
10 Hospital attendants.
2 Hospital attendants (N. C. officers).
32 Requisitioned carriages (30 for the sick, 1 baggage wagon, 1 provision wagon), (64 draught horses).

The transport columns are numbered 1 to 5. The sanitary trains will, as far as possible, be supplemented by ordinary railway trains in the conveyance of the sick and wounded to the permanent hospitals.

ESTABLISHMENT OF A SANITARY TRAIN.

1 Principal medical officer (Captain).
1 Medical officer (Captain or First Lieutenant).
1 Apothecary.
2 Hospital attendants (N. C. officers).
5 Hospital attendants.
10 Bearers.
15 Railway carriages.

The special material for furnishing three such trains is to be kept in store in the Federal magazines; that required for two trains already exists. After providing the establishment for the ambulance and sanitary trains, the remainder of the personnel of the "Landwehr" sanitary troops and, if necessary, other supernumeraries, will form eight hospital sections, each capable of manning a military

hospital of 200 beds. The establishment of these sections has not yet been fixed (1888), but will probably be as follows:

1 Principal medical officer.
2–3 Assistant medical officers.
1 Apothecary officer.
10–20 Hospital attendants.

A corps organization for the Swiss army was definitely adopted in 1891, and each of the army corps has attached to its staff a Chief Medical Officer. To each corps is also attached a corps field hospital. In the 2d Corps this hospital consists of four ambulances; each division has one Divisional Medical Officer (Lieutenant-Colonel), one Adjutant of Divisional Medical Officer, one Staff Clerk, and one Hospital Attendant. In the total staff there are:

38 Officers of field hospitals (including "Landwehr" train).
28 N. C. officers.
232 Lance-corporals and men.
20 Saddle-horses.
106 Draught-horses.
38 Carriages.

Among the number of officers and staff clerks at the immediate disposal of the Federal Council at the present time, are:

2 Medical officers (Colonels).
9 Lieutenant-Colonels.
9 Majors.
1 Apothecary officer (Major), all of the sanitary troops.

Of the supernumerary troops placed at the direct disposal of the General commanding the Army (in time of war) are the following:

5 Transport columns of the sanitary reserve.
3 Sanitary trains (Railway).
6 Hospital sections.

There are in the establishment of the Staff of the Army, Headquarters Duty Section:

1 Medical officer.
2 Hospital attendants.

The Medical Division of the Staff of the Army contains:

1 Principal Medical officer.
2 Medical officers (Adjutants), one of whom acts as medical officer of Headquarters Staff.
1 Staff clerk.

The normal and actual strength of the sanitary service ("Elite") are:

4,500 Sanitary troops, normal establishment.
4,950 Actual strength.

The "Landwehr" at present contains:

2,954 Sanitary troops, normal establishment.
1,555 Actual strength.

In the total of the sanitary troops of the "Elite" is included the 2d division of the "Landwehr" train battalion, which are required to horse the field hospital.

SANITARY TROOPS RECRUIT SCHOOL*—MEDICAL SECTION.

The session of the recruit school lasts forty-six days. It consists of a preparatory course of eleven days, during which the recruits are given the necessary military instruction in a school of infantry recruits, after which they undergo a technical course of thirty-five days. N. C. officers attend a cadre school during the last twenty-one days of this period. At the conclusion of the course candidates for the grade of Hospital Attendant are selected from the litter-bearers, and put through a further course of twenty-one days, termed a "Cours d'hospital," in Cantonal hospitals. In 1886 400 recruits passed through the recruit school, of whom 161 subsequently attended the hospital course, and all but four became hospital attendants. In 1887 434 recruits passed through the school.

REPETITION COURSE—MEDICAL SECTION.

It is provided in the military organization that all military medical officers shall, during their term of service, attend at least one repetition-course of fourteen days duration. This is termed a "Cours d'operation," and two are held each year, about twenty medical officers of the rank of Captain attending each. The instruction is partly medical and surgical and partly military.

SPECIAL COURSE FOR SUPERIOR MEDICAL OFFICERS.

Owing to the great changes in the duties of these officers, introduced by the new medical regulations, it was found necessary to

* From "The Armed Strength of Switzerland, 1889."

establish a course for the benefit of the Medical Staff. The instruction includes a series of practical problems to be discussed and worked out, both in the lecture-room and in the field, the exercises being directed by an officer of the General Staff. Twelve medical officers of the rank of Lieutenant-Colonel and Major went through a course of this nature in 1887, and it is proposed to extend the instruction to such medical officers with the rank of Captain as are nominated for promotion.

With regard to the personnel of the sanitary service, twelve out of forty ambulances are usually exercised each year. According to the scheme at present in force, five ambulances of each of the eight field hospitals are called out for three repetition-courses in ten years—two ambulances during the year of battalion exercises, four during brigade, two during regimental, and four during divisional maneuvers.

Of the sanitary personnel of the troops (infantry, cavalry, etc., as distinguished from the field hospitals), the senior medical officers of the battalions and four hospital attendants only in the infantry, and all the sanitary personnel of the special arms, perform their repetition-courses with their corps. The rest of the Infantry Medical Staff (Second Medical Officer, N. C. officers, and bearers) undergo their course with the ambulances. For the divisional and brigade maneuvers a detachment of sanitary troops is always to be called out and instructed under an officer of the Sanitary Staff.

Of 1,329 men, all ranks, of the medical personnel of corps, who should have attended the repetition-courses in 1886, 99 were absent without authority, while of 1,819 of the field hospitals, 162 were absent; but the greater part of those absent had received leave from their Cantons, which had not been reported to the Confederate authorities. In 1877 the absentees numbered only 64 out of 1,315 and 70 out of 1,847, respectively.

The Officers' Preparatory School, Medical Section, is located at Bâsle; two courses, each lasting thirty-two days, are given. After passing through the school, 40 or 50 medical men and 4 to 8 apothecaries are annually commissioned as sanitary officers. In 1887 three courses were held, and 71 medical men and 3 apothecaries entered the service.

Only physicians and apothecaries of suitable scientific acquirements, who have passed through a recruit school, can be nominated

to join officers' preparatory schools, with a view of obtaining commissions in the sanitary troops. The conditions to be fulfilled for the first appointment and promotion of officers are as follows: For Apothecary Officer, with the rank of Lieutenant, a certificate of capacity from an officers' preparatory school; with the rank of First Lieutenant, service as Junior Lieutenant for two years, and certificate of capacity.

For Medical Officer, with the rank of First Lieutenant, a certificate from an officers' preparatory school; with the rank of Captain, service as First Lieutenant for two years, and certificate of capacity; with the rank of Major, service as Captain for two years, and selection; with the rank of Lieutenant-Colonel, service as Major for two years, and selection; with the rank of Colonel, selection among the Lieutenant-Colonels.

Certificates of capacity for first appointments as officers are given at the termination of the session of the Officers' Preparatory School. They are signed by the Commandant of the School, according to the vote of the majority of the instructors, and countersigned by the "Chef d' Armée." In these, besides qualification in the various branches of professional knowledge, acquaintance with national and foreign languages is noted. Certificates of capacity for promotion are given by the chief instructors, who form their opinion from the reports made on the candidates at the courses of instruction, consideration being given to the right of nomination, which is vested by law in the immediate commanding officers of the persons concerned. Commanding officers submit their nominations through their immediate superiors, and these in forwarding the nominations to the Chief Instructor also express their opinions on the proposed officers. The certificates are submitted to the "Chef d'Armée" (and divisional commanders in the case of infantry) for their counter-signature, and finally transmitted to the Military Department. The chief instructors, if they deem it necessary, are empowered to examine officers proposed for promotion before issuing certificates of capacity.

Officers who have been relieved from service on account of age may be re-employed, if they wish it, and the authorities think fit. Mounted officers are entitled to a civilian servant, or allowance in lieu thereof, both on active service and during instructional courses; the daily allowance for a civilian servant is sixty-five cents, or fifty

cents if ration or quarters are found. Civilian servants who are sick or injured in service are entitled to free rations, quarters, and medical treatment, and to ten cents daily, and all civilian servants are subject to military law.

Men sick in hospital are subsisted by the hospital authorities, and for the subsistence and treatment of officers sent to hospital during instructional service a daily allowance of fifty cents is authorized; on active service, however, the Confederation pays for the subsistence and medical treatment of all sick officers.

PENSIONS AND INDEMNITIES.

Mere length of service confers no claim to pension in the Swiss Army. Every three years the Federal Council (which is the supreme authority in all matters relating to pensions) nominates a commission, which sits under the direction of the Military Department, and investigates all claims on behalf of the Council.

This "Pensions-Kommission" consists (1889) of the Chief Medical Officer, a Brigadier-Colonel, a Lieutenant-Colonel of Infantry, and a Medical Officer.

TRANSPORT.

The Communes provide not only all the requisitioned carriages laid down in the regulations, for which they receive an indemnity, but must also comply without delay with all requisitions for transport for military purposes. Under the latter head are included: provision and baggage-wagons for corps; wagons for the sick required by the field hospitals and transport columns of the Sanitary Reserve; harness and wagon-covers for the above, if they can not be furnished from corps material; wagons, horses, and drivers for provision columns and lines of communication carriage parks; the same for transports of detachments and single soldiers, sick, baggage, etc., for which army transport is not provided; horses for assisting transport to ascend steep hills; pack-animals, carriers, guides, workmen to clear and repair roads, etc., and transport boats.

SANITARY SERVICE DUTIES.

I. MEDICAL BRANCH.

The Chief Medical Officer, the permanent official at the head of this branch, has the following duties in time of peace: He is responsible for the recruiting and instruction of the sanitary troops, and for the preparation of regulations regarding the medical service. He nominates medical officers for appointment, promotion, and retirement. He distributes the sanitary of the personnel of all ranks to the various units, with the approval of the Military Department. He has the superior direction of the commissions appointed to conduct the medical examination of recruits for all arms. He is responsible that sanitary material of every description and the clothing and equipment of the sanitary troops are complete and fit for immediate use. He organizes the medical service for all assemblies of troops, whether for instructional purposes or for active service, indicating the hospitals and dispensaries which are placed at their disposal, and makes such proposals and arrangements as he thinks necessary for insuring the health of the troops, including questions of provisioning, clothing, and housing the men. He exercises general supervision over voluntary-aid associations. Reports on all claims for pension or indemnity, and is *ex officio* a member of the Pension Commission. He checks and countersigns all accounts connected with the medical service, and prepares the yearly estimate for the medical service.

On mobilization for active service, the medical peace establishment of an assistant, a secretary, and a clerk is augmented by a deputy (a senior medical officer), a Chief of the Hospital Service, a Chief of the Voluntary-Aid Service, and a Staff Apothecary. The Chief Medical Officer is then charged with making all arrangements for putting the medical service on a war footing, the augmentation of personnel and material, establishment of military hospitals, arrangements for the transport of the sick from the initial stations of the lines of communication rearward, the instruction of newly raised levies, organization of voluntary aid, and supervision of the entire territorial sanitary service, and its co-ordination with that of the troops in the field.

The Chief of the Hospital Service superintends the organization and administration of the permanent hospitals, and keeps the Chief

Medical Officer of the lines of communication informed of the available accommodation in these hospitals.

The Chief of the Voluntary-Aid Service superintends the general working of volunteer ambulance associations, and maintains constant communication with the Principal Medical Officer of the army in the field, with the object of insuring the useful employment of the personnel and material placed at the disposal of the State by voluntary associations.

The Staff Apothecary, in peace and war, superintends the provision, and is responsible for the quality, of all drugs supplied to the army.

The directing medical officers of the field army are, the Principal Medical Officer, the Corps, the Divisional, and Infantry Brigade Senior Medical Officers. They are under the orders of the military commanders to the staffs of whom they are attached, and responsible to them, as well as to their own medical superiors, for the conduct of the whole medical service of troops under their supervision. The commanding officers are required to give them such information as to proposed movements of troops, and especially as to dispositions for impending engagements, as will enable them to make suitable arrangements for the dressing stations, etc., and a directing medical officer must, in all cases, submit his proposals for the general organization of the medical service in the field for the approval of the Commanding Officer, or his Chief of Staff, before issuing orders on the subject.

The Principal Medical Officer with the troops keeps the Chief Medical Officer constantly informed of all important occurrences in the field which require to be known at the home medical headquarters; is responsible for the co-ordination of the field service with that of the lines of communication; for the timely demand for medical supplies and re-enforcement of personnel; and, generally, for the working of the entire medical service of the army in the field.

The Chief Medical Officer on the lines of communication is under the orders of the Principal Medical Officer of the army. He is responsible for the arrangements for the transport of the sick and wounded from the field to the permanent hospitals, and, to this end, has under his orders the transport columns, sanitary trains, the transport corps attached to them, and the lines of communication

hospitals, and medical service generally. He is further responsible for the mobilization of the requisite number of transport columns at the terminal stations, and for their being in immediate communication with the ambulances and provisional hospitals in the field, and, generally, for the establishment and distribution of the requisite sanitary trains and lines of communication hospitals at suitable stations. He reports all returu transport of sick to the Chief of the Hospital Service.

The Divisional Medical Officers are responsible at all times for the entire medical service of their divisions. In time of peace (and when no Principal Medical Officer of the army is appointed) they are under the orders of the Chief Medical Officer in all matters of sanitary service; when on active service, under those of the Principal Medical Officer of the army. The field hospital and all other sanitary troops of the division are under their orders. In time of peace the Divisional Medical Officer is President of the Medical Commission for Recruiting; keeps the rolls of the entire medical personnel of the division; is responsible for keeping the Chief Medical Officer informed of all changes in the establishment of the medical officers and other sanitary personnel of the various corps, and for the appointment, promotion, and retirement of the non-commissioned officers; he also iuspects the field hospitals at repetition-courses, and proposes the hygienic measures necessary for maintaining the health of the troops. On the field of battle he fixes the principal dressing and ambulance stations, according to the general indications of the Chief of Staff, and takes the requisite steps for evacuating the wounded.

For every permanent place of assembly of detachments of troops and every permanent Federal barrack station the Surgeon-in-Chief nominates a Station Surgeon ("Medicine de place") who is chosen from among the resident medical officers serving or retired from service. As a rule, the engagement is for one year.

When any body of troops assembles at his station without its medical officers the Station Surgeon performs the duties of the latter, and he also assists, with his advice and otherwise, the medical officers who may be called upon for duty with these troops. If there is a military hospital at the station he is *ex officio* Surgeon thereto, and he is responsible for the sanitation of the barracks and the health

of the troops quartered in them. For every day of service he receives $1.35 pay, with sixty cents extra for each day on which he acts as Surgeon to a military hospital. If he accompanies the troops during exercise in field service he receives the pay of his rank, and horse allowance.

The routine duties of the medical service may be considered under the following heads: With the troops, in field hospitals, in permanent hospitals, and when the sick are treated by private physicians.

The medical staffs of the various units have heretofore been enumerated. The personnel attached to the line consists of medical officers, bearers, and hospital attendants, whose duty is to give first aid to the sick and wounded. During peace time, and when in cantonment, mild cases of illness, which are not likely to last more than a few days, are treated in corps infirmaries, but the more severe cases are removed to civil hospitals. There are military hospitals in several of the large barrack towns, as Bern, Thun, Lucerne, etc., but these are ordinarily open only during the training seasons. At stations where such do not exist, a soldier during training is treated in civil hospitals, and, if his illness is not traceable to his own neglect or misconduct, at the expense of the Confederation.

The Swiss field hospital may be looked upon as a medical battalion, consisting of a staff and five companies, the latter being termed "ambulances." The staff has sixteen requisitioned wagons, of which twelve are fitted up for the wounded (and attached, as required, to one or the other of the ambulances), two for provisions, and two for baggage and cooking; and a column of reserve material, consisting of two wagons of medical stores and sixteen spare horses. Each ambulance, which is really a movable field hospital, has four wagons, including one for the wounded. In time of war all these are horsed and driven by the 2d Division of the "Landwehr" train battalion of the division; in time of peace, by supernumerary men of the two divisions of the "Elite" train battalion, or any soldiers available. Further material for two mountain ambulances (arranged for pack animals) is at the disposal of the 8th Army Division, and each field hospital is capable of forming two small mountain ambulances.

The ambulances can be used for the following purposes: To form sick depots, *i. e.*, corps infirmaries for several units; as collecting stations during marches; as principal dressing stations during

engagements, and as evacuating stations at the terminal stations of the lines of communication.

The removal of the sick and wounded from regiments and dressing stations of the first line to the principal dressing stations may be effected by the ambulance wagons (one per ambulance), and the carriage column of the field hospital (twelve wagons attached to the ambulances); but whenever possible, as during peace service, the troops themselves remove their sick to the ambulances in their own transport. If "Landwehr" troops should be attached to a division, a "Landwehr" ambulance will be added to the "Elite" field hospital thereof.

The above arrangements complete what are known as the first and second lines of medical assistance, which are concerned with the treatment and evacuation of the wounded on the field of battle, and are under the orders of the Divisional or Principal Medical Officer of the army. In rear of these again is organized a third line, consisting of permanent hospitals, which are placed at the limit of the field of operations, or on the lines of communication.

As a rule, sick and wounded who can not be treated with their regiment or in the field hospitals (*i. e.*, ambulances) will be, in time of peace, removed to the civil hospitals engaged by special contract. If these do not suffice in time of war permanent hospitals are established (classified as principal and reserve hospitals, special hospitals for infectious diseases, and convalescent stations), which are under the immediate orders of the Chief of the Hospital Service before mentioned, and which are manned by the hospital sections, assisted by voluntary-aid associations. Material for 5,000 beds complete is always kept up for these establishments in the depots at Bern and Lucerne.

The transport of sick from the field establishments to the permanent hospitals is effected by the five transport columns furnished by the "Landwehr," ordinary railway trains, and sanitary trains, steam vessels, and the medical service of the lines of communication.

With regard to the private medical attendance of sick and wounded, special permission of the Chief Medical Officer is required, and men so treated renounce, as a rule, all claims to indemnity, etc.

The actual working of the sanitary service on the field of battle is as follows: In the case of a single regiment of infantry, say,

2,332, all ranks, each company during the advance to combat is accompanied by its bearer in the firing line. The medical portion of the staff of each battalion (consisting of two medical officers, two non-commissioned officers, two hospital attendants, and twelve bearers) remains in rear and joins that of the other two battalions to form a regimental sanitary column. This then becomes an independent unit, under the orders of the Senior Medical Officer, who puts his detachment, now fifty-four strong (including the five other medical officers) in rear of the regiment, and follows it according to the directions of the regimental commander. The corps sanitary material, in the battalion "fourgon," consisting of eight stretchers per battalion, and the medical knapsacks and dressing-bags, are taken out and carried by the bearers in turn. As soon as the regiment becomes seriously engaged the regimental Medical Officer organizes his column as follows: 1. Bearers are sent to the front in squads under the non-commissioned officers, forming patrols to search for, and relays to bring in the wounded; and 2. The first line dressing station is established at a place selected or approved by the regimental commander, say 900 to 1,100 yards in rear of the principal line of combat, or nearer, if there is cover. If possible, the troops will be informed of the position of this station, and it will be marked by waving flags or fixing red lanterns. The non-commissioned officers in charge of the searching squads carry small horns, for the purpose of signaling to their men.

The detachment is then divided into groups: 1. For the reception and sorting of the wounded (where a tag showing the nature of the casualty is affixed to the wounded man, after which he is carried to one of the following groups); 2. Operating group, by which urgently required operations are executed; 3. Group for treatment of wounded and those who have been operated upon; preparing them for removal to the ambulances, bandaging, applying splints, etc.; 4. Group for the slightly wounded, who will be treated at leisure; 5. Group for receiving the dead and dying, with which is the Regimental Chaplain.

It may be mentioned here that the antiseptic bandages provided for use in the field are carried by the medical officers and bearers in parchment paper envelopes. It was at one time intended to provide each man with a bandage, as in the German Army, but experiments in the field showed that bandages, if constantly carried on the person, soon deteriorate from dust and moisture, and are frequently put

to other uses by the men. Detached parties, however, are to be supplied with packets when away from medical assistance.

Each of the five ambulances of a field hospital forms a complete mobile hospital, capable of independent action in any position. The "fourgon" of each ambulance contains the necessary outfit for this purpose, with drugs and appliances sufficient for forty patients for two months, or for the treatment of 200 wounded after a battle; it also carries bedding for forty or fifty patients. The wagon for wounded carries twelve men sitting or six lying down.

As a reserve to the ambulances the staff of the field hospital has, in its two reserve "fourgons," sufficient bedding for eighty to one hundred men, with a store of drugs and hospital utensils; it also has the sixteen requisitioned wagons above mentioned. As a rule, one ambulance is employed to form the principal dressing station for each brigade, the others being utilized in one of the various ways before indicated, or kept in reserve to re-enforce one or other of the two already in action. The ambulance for each brigade is established during an engagement two kilometers from the firing line, or one kilometer in rear of the center of the first line of medical assistance. The approximate position will be indicated by the commanding officer (Brigade or Divisional) after the directing medical officer has offered his opinion.

For the transmission of his orders to the Chief of the Field Hospital, or the chiefs of ambulances, the commanding medical officer is provided with mounted orderlies (guides or train non-commissioned officers). As soon as the ambulance is established the Senior Medical Officer sends his wagons for the wounded to the dressing stations of the first line, so as to be ready to bring in those who may have already been received there, and divides his detachment into groups, according to the facilities offered by the buildings or locality he has occupied. As a rule, these groups will comprise: 1. A receiving party, which will examine and classify the cases, passing them on to the other groups, and making out the admittance returns; 2. A subsistence section, under the Quartermaster, which will undertake all the duties connected with the messing of the establishment; 3. A surgical section, which will further be divided into sub-sections for (*a*) operations, (*b*) setting fractures, and (*c*) simple dressing; 4. A hospital section, dealing with the quarters and bedding of the

wounded. The wounded, and those operated upon who can not be moved with safety, will be provided for in this section, transportable cases requiring continued treatment being moved, as soon as possible, to the third line. If the establishment of the ambulance is not sufficient, it may be re-enforced by one of the ambulances kept in reserve, by order of the Divisional Medical Officer. If the forces engaged continue to advance, the ambulance must necessarily remain stationary for some time, and one of the unemployed ambulances must follow up the troops, and similarly in case of retreat.

The Chief Medical Officer of the lines of communication, as soon as possible, dispatches sections of the "Landwehr" transport columns, to insure the evacuation of the ambulances, and to organize the transport of convoys of wounded to the nearest terminal stations; or sanitary trains, etc., may be employed to remove the wounded toward the permanent hospitals. If, however, owing to the large number of untransportable sick, an ambulance can not be evacuated for some time, it may form itself into a provisional field hospital; and the equipment has been carefully arranged with a view to this contingency.

The regulations regarding voluntary aid in time of war provide that such assistance may take the form of personal help in nursing, outside the immediate sphere of military operations, and in the transport of the sick and wounded, and also that of gifts of medical comforts, etc.; but all such assistance must be organized under a responsible direction, *and placed, in all respects, under the supreme military control.*

In addition to the medical officers serving with the troops, the Confederation has at its disposal in time of war the services of all medical men who are within the limit of age prescribed for the "Landsturm."

It is specially provided that on a general mobilization, consulting surgeons may be nominated by the Chief Medical Officer and called in to serve by the Military Department, which will fix the rate of pay to be granted them. They must be men of superior professional standing, and may be placed at the disposal of the Principal Medical Officer of the Army, or employed in permanent hospitals.

In 1880 a "Société Militaire Sanitaire" was formed in Bern by the members of the sanitary troops, its object being to promote the im-

provement of its members in the theory and practice of military sanitary art, by means of lectures, etc. In the following year societies were established in several other towns, and a central committee was formed. Besides the mutual improvement of members, these societies charged themselves with the formation of "Sociétés Suisse de la Croix Rouge," having as their object the providing of voluntary aid for time of war, by educating the civil population in the art of giving first-aid to the wounded. In 1882 a "Société Centrale de la Croix Rouge" was formed, its aim being to organize the personnel and material of the voluntary-aid movement. In 1883 the central committee of the Society, with which most of the local military societies had affiliated, as sections, was removed from Bern to Bâsel. In 1885 the Military Department, recognizing the value of these organizations as a means of extending the knowledge of the members of the sanitary troops, of whom they were composed, commenced granting a small annual subsidy to the sections which had joined the central society. In 1886, on the initiative of the military sanitary societies, several "Sociétés de Samaritains" were formed, and instructed after the model of the ambulance societies in England and Germany, their object being to enable their members (policemen, railway employes, and private individuals) to give first help in case of accidents of all kinds. In 1887 there were thirteen of these military sections, with 274 members, affiliated to the central society, and most of the "Samaritain" societies had amalgamated as sections of a central association, the Military Department granting them also a small subsidy. In case of war, it is foreseen that the latter societies could be utilized with great advantage in rear of the army, to accompany convoys of sick on the road between detraining stations and the hospitals.

RECAPITULATION.

COMPOSITION OF THE SANITARY ORGANIZATIONS.*

The sanitary organizations are composed of the sanitary personnel and the attached personnel. The first consists of:

1. The sanitary officers.
   (*a*) Military medical officers.
   (*b*) Military apothecary officers.

* Data furnished by the Information Division A. G. O., U. S. Army.

2. Sanitary non-commissioned officers and soldiers.

(*a*) Non-commissioned officers.
(*b*) "Infirmiers."
(*c*) "Brancardiers" (litter-bearers).

The attached personnel. To the units of the sanitary troops are attached:

1. The necessary quartermasters furnished by the Administration troops.

2. The chaplains.

3. The second division of the train battalion of the "Landwehr" of the corresponding division, as hospital train.

4. The necessary "cadres" for the transport columns.

5. The personnel of the volunteer-aid societies.

DISTRIBUTION OF THE MEDICAL PERSONNEL.

There are attached,

I. To the Chief Medical Officer in case of general mobilization:

1 Sanitary officer, his Lieutenant (a Lieutenant-Colonel).
1 Chief of the Hospital Service (a Lieutenant-Colonel).
1 Chief of the Voluntary-Aid Service (a Lieutenant-Colonel).
1 Staff Apothecary (a Major).

II. To the Staff of the Army:

(*a*) 1 Medical Director of the Army (a Colonel).
2 Adjutants (Majors or Captains).
1 Staff Secretary.
2 "Infirmiers."

(*b*) To the Commander-in-Chief of the lines of communication:

1 Surgeon-in-Chief of the lines of communication (Lieutenant-Colonel or Major).
1 Adjutant (Captain or First Lieutenant).
1 Secretary.

III.—To the Staff of an army officer:

1 Chief Corps Medical Officer, whose staff, not yet announced, will doubtless be about the same as that of the Division Medical Officer.

IV. — To the staff of a division:

1 Division Medical Officer (Lieutenant-Colonel).
1 Adjutant (Captain or First Lieutenant).
1 Staff Secretary.
1 "Infirmier."

V. — To the Staff of an infantry brigade:

1 Brigade Medical Officer (Major).

VI. — To the Staff of an infantry regiment:

1 Captain (selected for the duty from the battalion medical officers of the regiment).

VII. — To each battalion of fusiliers or carboniers:

1–2 Medical Officers (Captains or First Lieutenants).
2 Non-commissioned officers.
6 "Infirmiers," of whom the battalion medical officer will attach one to each company.
12 Bearers.

VIII. — To a regiment of Cavalry:

a. To the Staff: 1 Medical officer (Captain or First Lieutenant).
b. To each squadron: 1 "Infirmier."

IX. — To a brigade of artillery:

1 Captain (designated for the duty from the battery medical officers).

X. — To a regiment of artillery or a divisional park:

1–2 Medical officers (Captains or First Lieutenants). These are selected from battery or park column medical officers.

XI. — To each field battery or park column:

1 Medical officer (Captain or First Lieutenant).
1 "Infirmier."
2 Bearers.

XII. — To a mountain battery, and to a company of position, each:

1 Medical officer (Captain or First Lieutenant).
1 "Infirmier."
2 Bearers.

XIII.—To a train battalion:

1 Medical officer (Captain or First Lieutenant), to each division in the "Landwehr" to the I and III. After the departure ofthe divisions of the train battalion for the engineer battalion, and for the administration company, the medical officer of the train battalion enters the staff of the field hospital as Adjutant.
1 "Infirmier."

XIV.—To a company of artificers:

1 "Infirmier."

XV.—To an engineer battalion:

a. To the staff: 1–2 Medical officers (Captains or First Lieutenants).
b. To each company: 1 "Infirmier," and 2 bearers.

XVI.—To an administration company:

1 Medical officer (Captain or First Licutenant), and to a subsistence section, 1 "Infirmier."

XVII.—The staff of a field hospital:

1 Chief of Field Hospital, Major (a medical officer), and as Adjutant, the medical officer of the train battalion).
1 Officer of Administration (Captain or First Lieutenant).
1 Apothecary officer (Captain or First Lieutenant).
1–2 Chaplains.
1 Sergeant-Major of the sanitary troops.
1 Non-commissioned officer as clerk.

XVIII.—An Ambulance is composed of:

1 Chief of Ambulance, Captain (a medical officer).
3 Medical officers—at least—(Captains or First Lieutenants), and in case of war, 3 medical students.
1 Quartermaster (First Lieutenant or Lieutenant).
1 Apothecary officer (First Lieutenant or Lieutenant).
4–6 Non-commissioned officers.
10 "Infirmiers."
20–24 Bearers.

XIX.—The Mountain ambulances are formed in case of necessity with the personnel of the ordinary ambulance and equipped with the mountain material.

VII. THE ARMY OF ITALY.*

The Military Sanitary Corps consists of:

a. 1 Military Sanitary Inspectorate.

b. 12 Military Sanitary Territorial Directorates.

c. An indefinite number of Principal Military Hospital Directorates.

d. Medical Officers.

e. 12 Sanitary Sections (or Companies).

a. The Military Sanitary Inspectorate is composed of:

1 Inspector-in-Chief (Surgeon-Major-General).
2 Sanitary Inspectors (Surgeon-Major-Generals or Surgeon-Colonels).
1 Apothecary Director.
1 Secretary.

b. Each Territorial Directorate has:

1 Surgeon-Colonel as Director.
1 Surgeon-Lieutenant.
1 Clerk.
1 Orderly.
3 Attendants.

c. The Principal Military Hospital Directorates are established, whenever necessary, by royal decree.

d. The number of medical officers assigned to the different combatant organizations is as follows:

Regiment Alpini (3 or 4 battalions), 1 Surgeon-Subaltern per battalion.

Regiment of Infantry or Rifles (3 battalions), 1 Surgeon-Captain, 2 Surgeon-Subalterns, with regimental Staff.

Regiment of Cavalry (2 battalions per regiment) 1 Surgeon-Captain, 1 Surgeon-Subaltern, with regimental Staff.

Regiment of Field Artillery, Corps or Divisonal (2 brigades), 1 Surgeon-Captain, 1 Surgeon-Subaltern, with regimental Staff.

Horse Artillery Regiment (3 brigades and 1 train brigade), 1 Surgeon-Captain, 1 Surgeon-Subaltern, with regimental Staff.

Mountain Artillery Regiment (3 brigades), 1 Surgeon-Captain, 2 Surgeon-Lieutenants, with regimental Staff.

Regiment of Fortress Artillery (3 brigades), 1 Surgeon-Captain, 1 Surgeon-Subaltern, with regimental Staff.

Regiment of Fortress Artillery (4 brigades), 1 Surgeon-Captain, 1 Surgeon-Subaltern, with regimental Staff.

Regiment of Engineers (7 brigades), 1 Surgeon Captain, 1 Surgeon-Subaltern, with regimental Staff.

---

*I am indebted to the Military Information Division of the War Department for many of the facts herein stated.

Regiments of Engineers, differently constituted, have the same proportionate allowance of medical officers.

Every regiment, and in case of the Alpini every battalion, has a Corporal or Lance-Sergeant, as sanitary assistant, except the regiment of mountain artillery, which has three.

The officers of the Sanitary Department are graduates of the military medical school at Florence.

Each Foot Sanitary Section consists of:

	Officers.	Enlisted.	Civilians.	Horses.
Surgeon-Captains,	2	....	....	2
Surgeon-Subalterns,	4	....	....	....
Accountant-Subaltern,	1	....	....	....
Chaplain,	....	....	1	...
First Sergeant or Sergeant,	....	1	....	....
Sergeants or Lance-Sergeants,	....	2	....	....
Lance-Sergeants or Corporals, Sanitary Assistants (3 of them apothecaries),	....	6	....	....
Lance-Sergeants, bearers,	....	3	....	....
Corporal Sick-Attendants,	....	3	....	....
Corporal-Bearers,	....	8	....	....
Privates, Sick-Attendants,	....	14	....	....
Privates, Bearers,	....	132	....	....
Attendants (officers),	....	8	....	....
Total sanitary personnel,	7	177	1	2
Section of train,	1	25	....	28

4 two-wheeled and 8 four-wheeled vehicles.

The strength of each Mounted Sanitary Section is:

	Officers.	Enlisted.	Civilians.	Horses.
Surgeon-Captain,	1	...	....	1
Surgeon-Subaltern,	1	....	....	....
Accountant-Subaltern,	1	....	....	....
Chaplain,	....	....	1	....
First Sergeant or Sergeant,	....	1	....	....
Lance-Sergeant,	....	1	....	. ..
Lance-Sergeants or Corporals, Sanitary Assistants (1 of them apothecary),	....	2	....	....
Corporal Sick-Attendant,	....	1	....	....
Corporal-Bearer,	....	1	....	....
Privates, Sick-Attendants,	....	4	....	....
Privates, Bearers,	....	20	....	....
Attendants (officers'),	....	4	....	....
Total sanitary personnel,	3	34	1	1
Detachment of artillery train,	....	13	....	14

2 two-wheeled and 4 four-wheeled vehicles.

The Sanitary (Hospital) Corps, in active service, is assigned as follows, viz.:

> 1 section to each infantry and cavalry division, and a headquarters or extra section to each Corps d' Armée.

The organized militia likewise has twelve sanitary sections. The uniform of the Army Hospital Corps is similar to that of the infantry, excepting that the badge on the shako is a star, with the Geneva Cross and a white pompon, with the number of the company in red, and the Geneva badge on the arm. The men carry side arms only.

Preliminary estimates for the Italian Army for 1894–95 provide for a sanitary organization as follows, viz.:

13 Surgeon-Colonels.
26 Surgeon-Lieutenant-Colonels.
55 Surgeon-Majors.
283 Surgeon-Captains.
288 Surgeon-Lieutenants, and Second Lieutenants.*
Total, 665.

12 Accountant-Majors.
25 Accountant-Captains.
57 Accountant-Lieutenants and Second Lieutenants.
Total, 94.

With a number of "Scrivani Locali" (clerks) for the hospitals about ninety.

115 Under officers (Sergeant-Majors, First Sergeants and Sergeants).
42 Lance-Sergeants (Sanitary assistants and bearers).
12 Lance-Sergeants or Corporals (for accountant duty).
290 Corporals (Sanitary assistants, attendants, and Bearers).
1,840 Privates (Sanitary assistants, attendants, and bearers).
Total, 2,299.

There are also in this service in the neighborhood of one hundred apothecary officers, whose duties are chiefly in connection with the medical supply depots:

The following table shows the organization before the enactment of the law of 1884, which law was enacted as a measure of economy, rather than efficiency:

---

* These may be replaced in part by Surgeon-Second Lieutenants of the reserve.

ORGANIZATION.	MED. OFFICERS. Major General	MED. OFFICERS. Field Officers.	MED. OFFICERS. Captains	TROOPS. Lieutenants.	TROOPS. Sergeants.	TROOPS. Corporals	TROOPS. Privates.	Horses.
Inspection of Military Sanitation,	3	3	3	....	....	....	....	9
12 District Directions (12 Army Corps),	...	12	12	....	....	....	....	36
Hospitals and 12 Medical Companies,	....	77	18	72	103	275	1,925	172
School of Application, Military Medicine,	....	4	2	4	4	2	128	10
1 Legion Carbineers (cadets),	....	....	1	1	....	....	....	1
115 Regs. Infantry, Bessaglieri, Alpine,	....	....	108	238	....	....	....	108
87 Military Districts,	....	....	87	....	....	....	....	87
1 Disciplinary Company,	....	....	....	....	....	....	....	....
Penitentiary,	....	....	2	....	....	....	....	2
24 Regiments Cavalry,	....	....	24	24	....	....	....	24
31 Regiments Artillery,	....	....	31	32	....	....	....	31
4 Regiments Engineers,	....	....	4	4	....	....	....	4
Invalid and Veterinary Schools and Colleges,	....	....	8	1	....	....	....	8
Totals,	3	96	300	376	107	277	2,053	492
Totals,	....		772			2,437		

WAR ESTABLISHMENTS.*

With the intendants at the headquarters of an army in the field there is an Army Sanitary Directorate, organized as follows:

ARMY HEADQUARTERS SANITARY DIRECTORATE.

	Officers.	Enlisted.	Civilians.	Horses.
Director (Surgeon-Colonel),	1	....	....	2
Surgeon (Surgeon-Lieutenant-Colonel)	1	....	....	2
Surgeon-Captains,	4	....	....	4
Surgeon-Subalterns,	4	....	....	....

* From the "Instruzione per la mobilizatione del R. esercito, Tomo I, Formazioni di Guerra, 20 luglio. 1892."

Chief Apothecary,	....	....	1	....
Apothecaries,	....	....	3	....
Clerks,	....	2	....	....
Officers' Orderlies,	....	2	....	....
Attendants (officers' servants),	....	15	....	....
Detachment of train:				
Sergeant,	....	1	....	1
Lance-Sergeant,	....	1	....	1
Corporals, saddlers, etc.,	....	5	....	....
Lance-Corporals and privates,	....	12	....	....
With 5 vehicles of all kinds, including forage and ambulance wagon,	....	....	....	18
Total,	10	38	4	28

There are also fifteen field hospitals attached to headquarters, each organized as follows:

FIELD HOSPITAL — 200 BEDS.

	Officers.	Enlisted.	Civilians.	Horses.
Director (Surgeon-Major or Captain),	1	....	....	2
Surgeon-Captains,	2	....	....	2
Surgeon-Subalterns,	4	....	....	....
Accountant-Subaltern,	1	....	....	....
Apothecary,	....	....	1	....
Chaplain,	....	....	1	....
First Sergeant,	....	1	...	....
Sergeants or Lance-Sergeants,	....	2	....	....
Sanitary Assistants (2 of them apothecaries),	....	5	....	....
Corporal Sick-Attendants,	....	2	....	....
Corporal-Bearers,	....	2	....	....
Sick-Attendants, Lance-Corporals, and privates	....	18	....	....
Bearers, Lance-Corporals. and privates,	....	12	....	....
Attendants (officers'),	....	10	....	....
Civilian train, with 1 four-wheeled † and 8 two-wheeled vehicles,	....	....	11	20
Total,	8	52	13	24

There are also field hospitals of 100 beds and mountain hospitals of fifty beds, with a less personnel than that given in the table.

†NOTE.—The four-wheeled vehicle is an omnibus for carrying the subaltern officers, the Apothecary, the Chaplain, and if necessary, the sick.

As a maximum, each army in the field has at its disposal four transport (railroad) trains for sick and wounded, organized as follows.

HOSPITAL RAILWAY TRAIN.*

	Officers.	Enlisted.	Railway Cars.
Train-Director (Surgeon-Captain),	1	....	....
Surgeon-Subalterns,	3	....	....
Non-Commissioned officers,	....	2	....
Lance-Sergeants, or Corporals, Sanitary assistants,	....	5	....
Attendants (officers' servants)	....	4	....
Privates,	....	35	....
Combination car,	...	....	1
Cars for transport of wounded,	....	....	35
Car for baggage,	....	....	1
Car for transport of chests of clothing and equipage, hospital stores, etc.,	....	....	1
Total,	4	46	38

The composition of the train, given in the above table, may be modified according to circumstances.

With the headquarters of each Army Corps (two divisions) there is a Corps Sanitary Directorate as follows, viz: †

	Officers.	Enlisted.	Civilians.	Horses.
Director (Surgeon-Colonel or Lieutenant-Colonel),	1	....	....	2
Surgeon-Lieutenant,	1	....	....	....
Clerk,	....	1	....	....
Officer's Orderly,	....	1	....	....
Attendants (officers'),	....	3	....	....
Total,	2	5	....	2

With each corps, headquarters and division of infantry there is a Foot Sanitary Section, and with each cavalry division a mounted Sanitary Section, the organizations of which have been previously given.

*Cars for the transport of wounded are provided with the necessary equipment, and each of them should be supplied with eight litters. 280 wounded may be carried on this train. Its enlisted personnel is ordinarily drawn from the territorial militia, and is attached, in accordance with orders from the Minister of War, to the Army Sanitary Directorate.

†The baggage, etc., of the Army Corps Sanitary Directorate is carried in one of the wagons of the Staff of the Corps, or else in the wagons of the sanitary sections attached, according to orders received from the Chief of Staff of the corps.

The sanitary organization for each regiment of infantry or rifles is as follows:

	Officers.	Enlisted.
Regimental Staff (Surgeon-Captain),	1	....
Battalion Staff (two Surgeon-Subalterns, each battalion),	6	....
1 Sanitary Assistant (Corporals) each battalion,	....	3
4 Bearers, each battalion,	....	12
Total,	7	15

Each regiment of cavalry has:

	Officers.	Enlisted.
Regimental Staff: Surgeon-Captain,	1	....
Sanitary Assistant (Corporal),	....	1
Battalion Staff: 1 Surgeon-Subaltern per battalion,	2	....
Total,	3	1

Each brigade of horse or field batteries has 1 Surgeon-Subaltern.

Each brigade of mounted batteries has:

	Officers.	Enlisted.
Surgeon-Subaltern,	1	....
Sanitary Assistant (Corporal),	....	1
Bearers,	....	2
Total,	1	3

VIII. THE RUSSIAN ARMY.*

The sanitary organization of the Russian Army is based upon the regimental hospital, each fighting unit (battalion) having its own sanitary personnel, appliances, and transport, Upon this, in active service, is engrafted a divisional organization following the lines of modern military sanitation. The sanitary personnel, the surgeons, have no military rank; they belong to a class designated "official," which includes all persons not actually fighting men, and they are considered as civilians attached. In common with all other Government officials, they have a standing according to their rank in the "chin."

* Data furnished from the Division of Military Information, Adjutant-General's Office, U. S. Army, and other sources.

All Russian military officials are known technically as "Voyennii Klassnii Chinovniki," and belong to one or other of the following-named classes: Chaplains, intendance officials, surgeons, veterinarians, artillery officials ("arteilleriiskii chinovniki"), engineer officials ("injeniernii chin"), apothecaries, officials of the various military educational establishments, etc. In these groups there are no special names for grades, which are only denoted by the particular class-rank in the "chin" which the individual official has, and which is, in effect, a social or court standing. For example, all surgeons are designated "vrachi," yet they have rank in the "chin," from the third class to the ninth class, the highest medical official having third class, and the lowest (Junior Surgeon) ninth class rank. The highest apothecary official ranks with the fifth class, etc. All surgeons wear a uniform of dark green cloth, the coat (tunic) having cuffs and collar, of the same color, piped with scarlet. The shoulder-knots are narrower than those of combatant officers, and are ornamented with silver lace. The trousers are dark green in color, without stripe, and the undress cap is of the same color, with a dark green band and red piping. The subordinate personnel wear the same uniform as the regiment to which their hospital belongs.

According to the Division of Military Information, Adjutant-General's Office, U. S. Army, the organization of the personnel of the Medical Department of the Russian Army is as follows:

I.—Chief Medical Department:

1 Chief Surgeon, 1 Assistant, 1 Chief Inspector, 4 Principal officials, (Surgeon, Veterinarian, Pharmacist, and Professor Oculist), 13 Surgeons, 1 Pharmacist, 18 Minor officials, 45 Clerks, and 4 Couriers.

In addition to the foregoing the Department has at its disposal:

5 Surgeons, 15 Pharmacists, 15 Veterinarians, and 28 Junior "Feldshers."*

II.—Military Districts and Staff:

a. District Military Medical Department:

1 Chief, 1 District Medical Inspector, 1–2 Assistants (Surgeon and Pharmacist), 1 Oculist Surgeon, and 1 Veterinarian, 1 Surgeon and

* "Feldshers" correspond in their duties to the Hospital Corps, U. S. Army.

1 Pharmacist, as Secretaries, and an indefinite number of "Feldshers" and Clerks.

b. Staff of Army Corps:
1 Corps Surgeon and 1 "Feldsher."

c. Staff of Infantry or Cavalry Division.
1 Division Surgeon.

d. Staff of Field and Reserve Artillery Brigade:
2 Surgeons, 1 Veterinarian, and 7 "Feldshers."

e. Staff of Sapper and Railway Brigade.
1 Surgeon.

III.—In the Line:

a. In a regiment of infantry, consisting of 4 battalions, there are 1 Senior and 4 Junior Surgeons ("vrachi"), 1 Senior and 12 Junior Dressers ("Feldshers"), 1 Compounder ("Abtechnii feldsher"), 14 Dresser pupils, 1 Hospital Sergeant ("Nadziratri Volriki"), and 3 Hospital Orderlies.

All these are classed as non-combatants.

The average strength of an infantry battalion is about 1,000 of all ranks; and the combatant companies, in a 4-battalion regiment are numbered from 1 to 16. All of the non-combatant officials in a regiment are grouped into what is called a non-combatant company, which is not numbered. The medical personnel allotted to other fighing units is in proportion to strength, based upon the requirements of an infantry regiment. A cavalry regiment has usually a strength of from 777 to 1,000 men, depending upon the number of squadrons (four or six). The artillery is organized into brigades of six battalions each, the average strength being 1,100 of all ranks in each brigade, etc.

b. A Cavalry Regiment (4 Squadrons) has:
1 Senior and 1 Junior Surgeon, 1 Veterinarian, 6 "Feldshers," (in 4-Squadron Regiment 7), 4 Veterinary "Feldshers," 2 "Feldsher" pupils, 1 Supervisor of Sick (non-commissioned officer), and 2 Hospital Attendants.

c. Of the Artillery:
A Foot Battery has 2 "Feldshers," 1 "Feldsher" pupil, 1 Hospital Attendant. A Horse Battery the same as Foot Battery. A Mortar Battery 4 "Feldshers" and 1 Hospital Attendant, and the Artillery Parks (Flying and Movable), each, 1 Surgeon and (?) "Feldshers," etc.

d. A Sapper Battalion has:
1 Surgeon, 7 "Feldshers," 5 "Feldsher" pupils, and 2 Hospital Attendants.

e. Reserve Infantry Battalion (4 companies) has:
1 Surgeon, 1 Junior Surgeon, 7 "Feldshers," and 5 "Feldsher" pupils, and

f. A Fortress Infantry Battalion the same.

g. A Depot Cavalry ("Cadre") has:
1 Junior Surgeon, 1 Veterinarian, 4 "Feldshers," 4 Veterinarian "Feldshers," 2 Hospital Attendants, etc.

The material, tentage, etc., of the regimental hospital, which always accompanies the fighting organization to which it belongs, is transported in four one-horse medical store carts. Besides these there are four four-horse ambulance wagons, and a two-horse wagon to carry thirty-two stretchers (two per company). In peace or war these regimental medical units are completely organized and the personnel is identical, except that the fourteen "Feldsher" pupils are replaced by eight additional junior "Feldshers," and the capacity of the hospital is extended from sixteen to eighty-four beds (twenty-one to each battalion of a thousand strong).

Each "Feldsher" carries a knapsack containing dressing materials. In addition to the "Feldshers," there are detailed from each company six men who are specially trained as bearers. A four-battalion regiment, sixteen companies, each of two hundred and fifty men, furnishes ninety-six bearers from the combatant strength; these men wear the arm-band of the Geneva Convention only when actually employed in bearer work.

During an action the regimental medical personnel form collecting stations, to which the wounded are carried. But the regimental hospitals are ordinarily not pitched, except at the time the regiment goes into camp.

During active service the various medical units, required on mobilization, are organized from the regimental peace establishment, supplemented by men from the reserve, the drivers coming from the cavalry reserve.

These units are in addition to the regimental medical organization, and are as follows, viz:

a. Sanitary division.

To each infantry division in the field is attached what is called a "Sanitary Division," and this forms a part of the divisional, supply, and transport column. The Sanitary Division consists of a bearer company, a divisional ambulance hospital, and two "Mobile" field hospitals. In the case of sanitary divisions attached to active, as distinguished from reserve infantry divisions, two extra "Mobile" hospitals are included, making four in all for that division. The divisional sanitary organization is intended for the establishment of a main dressing station, and to otherwise collect and dispatch the wounded from the fighting line to the field hospitals. The personnel consists of:

1 Officer (combatant) commanding.
5 Surgeons.
1 Official (Quartermaster).
29 "Feldshers," etc.
217 Non-Commissioned Officers and men of the Bearer Company.
39 Non-Commissioned Officers and men of the Transport Corps.
Total, 292.

The equipment consists of fifty stretchers, two thousand bandages (divided in ten packages), fifty first-aid knapsacks, the necessary medicines, stores, etc.; two operating tables, and four dressing tents. The transport comprises eight four-horse ambulance wagons, three one-horse medical store carts, fifteen two-horse store wagons, and one four-horse store wagon (for heavier parts of material).

Longmore gives a somewhat different organization. According to him the personnel of the Sanitary Division consists of, for the field hospital (to accommodate six officers and 160 men), viz: Eight Surgeons, sixteen Dressers, fifty Orderlies, with the necessary (?) officials.

Bearer Company: One officer, one Sergeant-Major, six Sergeants, and 200 Bearers.

Transport Section: One officer, and 108 drivers; total, 393. With the divisional sanitary train are: Twenty-four ambulance wagons, an equal number of store wagons, six stretcher carts, two medical store carts. Each train carries 144 stretchers.

The organization of the bearer company is practically identical with that of the other companies; the uniform is the same as that worn by the 1st Regiment of the division to which it belongs, and

the number of the division is shown on the shoulder-loop. The brassard of the Geneva Convention is worn, and no arms carried except by the drivers, each of whom has a hatchet, and who do not wear the brassard.

b. The divisional "Mobile" (field) hospitals constitute the third line of medical assistance, and each affords accommodation for ten officers and 200 men. Their rôle, location, and movements are the same as in other armies. The personnel of these hospitals consists of: Two Surgeons, two other officers, 107 non-commissioned officers and men (including twenty-eight for transport duties), four Sisters of Mercy, fifty-seven horses, and twenty-five wagons.

The equipment includes bedding and clothing for ten officers and 200 men:

210 bedsteads.
105 tables.
40 stretchers.
3 large tents, each to hold 20 men, and the necessary medical stores, food, etc.

The transport comprises:

19 two-horse store wagons.
1 four-horse wagon for heavy parts of tents.
4 one-horse store carts.
1 four-horse carriage for the Sisters.

The uniform of the personnel of these hospitals is the same as that of the 4th Regiment of the division, with the number of the hospital on the shoulder-loop. The arms and the use of the brassard are the same as described for a bearer company.

During a battle the divisional "Mobile" hospitals are established somewhere in rear of the line of battle. In addition to their permanent personnel, when necessary, Surgeons and Dressers are detailed from the regiments in sufficient number to meet the requirements of any particular emergency.

The divisional ambulance hospital constitutes the dressing station, which is located in the immediate rear of the fighting line. Its personnel is furnished by detail from the regimental Surgeons and the Bearer Company.

*c.** The reserve field hospitals, of which two hundred and forty are maintained, and in war are established at points on the line of communication. They have no transportation, their personnel and stores being forwarded by rail, boat, or by requisitioned transport. Each has:

5 Surgeons.
4 Officials.
80 "Feldshers," etc.
4 Sisters of Mercy.

Their organization is identical with that of the divisional field hospitals, except as to transport.

d. The Military Sanitary Convoys, twenty in number, are mobilized in time of war for the transport of wounded and sick from the front to the rear. The strength of each is one combatant officer in command, two surgeons, ninety-eight non-commissioned officers and men (including seventy-one for transport work), two Sisters of Mercy, 137 horses, and thirty-six carriages, including twenty-seven four-horse ambulances, one four-horse kitchen wagon, seven two-horse store wagons, and one one-horse medical store cart.

e. The Field Dispensaries are intended to supply the divisional and field hospitals with the medical and surgical stores they require. In time of war seven of these dispensaries are mobilized, each is provided with a supply equal to the requirements of four months, and has a personnel of three officials and twenty-one non-commissioned officers and men. Transport is provided when required. According to Longmore, twenty-eight store wagons are attached to each field dispensary, some of which follow the army in advance and others are distributed between the base and other points.

f. The Permanent Military Hospitals located in Europe, eleven in Caucasus, and six in Asia, are divided into four classes, as follows:

---

*Longmore says that in European Russia these hospitals number eighty-four, and are permanent formations. In time of war they follow a few marches in rear of the army. Each field hospital will accommodate thirty officers and 600 men, and can be divided into three equal sections. The personnel consists of one Commandant (non-medical), one Principal Surgeon, nine Surgeons, one Apothecary, two Compounders, 304 non-commissioned officers and men, of whom sixty-three belong to the transport service.

Each hospital has a train of twenty-seven carriages, which may also be employed to transport the sick to the hospitals further in rear. Both material and hospital stores are kept, in time of peace, in the intendance depots. The personnel and horses are organized only during active service.

PERSONNEL.	1st Class. 200 Beds.	2d Class. 400 Beds.	3d Class. 650 Beds.	4th Class. 1,100 Beds.
Chief,	1	1	1	1
Surgeons,	4	7	10	18
Officer,	....	....	....	1
Officials,	4	5	8	10
Apothecary,	1	1	1	1
"Feldshers."	8	13	20	33
Lower Grades,	76	114	152	233

g. Local hospitals. There are also in Europe about sixty, in Caucasus about forty, and in Asia about sixty, of from 50 to 350 beds each. Their personnel consists of two to seven surgeons, one to two apothecaries, one hospital supervisor, three to eleven "feldshers," seven to twenty-seven lower grades, and one nurse for each eight patients.

h. In every independent unit or command there is a troop hospital, which is to be opened when no military or local hospitals are available. Instead of troop hospitals receiving rooms of sixteen beds may be opened in each command. The personnel of these troop hospitals is determined by the regulations governing the sanitary service, as described in Par. 3 ("In the Line"), for each regiment, battery, etc.

i. The medical depots, of which the central medical depot is at St. Petersburg, and nine other military medical depots are established at different points in the Empire, are for the purchase, storage, and issuing of supplies.

Longmore says that all temporary hospitals are under the orders of the Director-General, who is attached to the General Staff of the army. Whether or not he be a physician does not appear — probably not, inasmuch as Longmore further says that the Director-General is assisted in his duties by the Chief Surgeon, as regards the medical details, and that the personnel of the hospitals are under his orders, except the surgeons, who are, however, subordinate to him in matters of discipline and administration. It is part of the duty of the Director-General, in active service, to see that all hospitals at the front are evacuated as rapidly as possible, in order to which, if the ordinary means of conveyance should be insufficient,

recourse can be had to the wagons of the intendance or of the country in which operations are being carried on. It is also his duty to establish new field hospitals and, generally, to control the supply, and see to the efficiency of all military sanitary establishments. He receives his orders from the Chief of the General Staff, and is in immediate communication with the Minister of War regarding medical supplies, etc.

The present total of the Medical Department of the Russian Army does not materially differ from that of 1886, which was—

2,808 Surgeons,
232 Pharmacists,
3,804 Medical "Feldshers,"
3,455 Company (squadron, battery) "Feldshers,"

and which may be said to represent the peace establishment of the Russian Military Sanitary Organization.

APPENDIX TO REPORT OF COMMITTEE ON ORGANIZATION OF AMERICAN BRANCH RED CROSS ASSOCIATION. (See p. 103.)

COPY OF MINUTES OF SPECIAL MEETING OF THE BOARD OF DIRECTORS OF THE AMERICAN NATIONAL RED CROSS.

A special meeting of the Board of Directors of the American National Red Cross was held at Red Cross Headquarters, in the City of Washington, on the first day of May, 1895, to consider the proposed report of the Committee appointed by the President of the Military Surgeons of the United States, at their fourth annual congress, May 2, 1894: "To consider the relation of the Red Cross Society to the Medical Department of the National Guard and to the Regular Medical Service of the Army."

After carefully reviewing the proposed report, the Board decided to submit the following objections, in justice to the Red Cross, National and International:

On page one of the report are these words: "The session lasted two weeks, during which the 'Articles of the Geneva Convention' were drawn up. In these there is no mention of national or other associations of voluntary relief."

We respectfully call the Committee's attention to their own account of the birth of the Red Cross. Did M. Henri Dunant, at the battle of Solferino, belong to the corps of military surgeons? Did he belong, in any manner, to the French, Italian, or Austrian Armies? In his valuable little book, "Un Souvenir de Solferino," he dwelt exhaustively on the necessity of more efficient aid in seconding the efforts of the physicians and the necessarily inadequate resources of the medical and surgical corps of the army.

Thousands upon thousands endured horrible suffering on the field of Solferino, even though Napoleon III., recognizing the fact that many suffered needlessly in every battle, had made special provision for the care and relief of his soldiers in this war.

M. Dunant's ideas, which came to him on that battle-field, and were afterward embodied in his book, were — that there ought to be a mutual desire upon the part of opposing armies to reduce the sufferings of wounded and disabled soldiers to a minimum; that there should be an increase in the medical corps of the armies, and that voluntary aid, other than military, must supplement the efforts of the physicians in the relief of suffering.

The Red Cross, if it stands for anything, stands for *Humanity* and Neutrality. If it means anything, it means *Civil Aid for Military Necessity*.

While it is true that, according to the *letter* of the "Articles of the Geneva Convention," there is no specific mention of "national or other associations of voluntary aid," let us look, for a moment, at the *spirit* of the Convention, and if the honorable Committee will but read the account of the proceedings of that Convention, the reason why no specific mention is made of voluntary aid will readily be noted. We quote from M. Moynier, the President of the International Red Cross:

"The Conference refrained from touching on the details of the arrangements to be made between governments and societies, in the belief that were it to do so, it would be stepping beyond its sphere; and besides, it would be quite impossible to recommend any system acceptable to all; it confined itself to the formal expression of a wish that the governments would accord their aptronage and protection to the societies."

When the proposal came before the Convention to allow civil surgeons and nurses to work on fields of battle, with military doctors and nurses, certain members of the conference opposed the suggestion as one full of peril.

By authority, it was stated that there the members of the Red Cross were to be governed by the strict rules of military law; that they were to be trained with the same rigid care; that the best means were to be applied to make their work equal to any corps of physicians or hospital nurses; that they were, at all times, to be entirely subordinate to the commanding officer. When this became known and understood, the opposers of the suggestion gave way, and when it was proved that it was always immediately after great battles that the insufficiency of official relief had been most evident, there was not a dissenting voice to the proposal. The same idea was ex-

pressed in that conference that your Committee advances, as to the difficulty of finding men sufficiently courageous to go, of their own free will, to succor the wounded under fire, but it was plainly and emphatically asserted that more volunteers would be found ready to brave bullets and shells for love of their fellows than to serve in the hospitals in the rear, to which it was desired to confine them.

The following proposition was unanimously adopted: "On the demand, or with the concurrence of the military authorities, the Committee shall send volunteer nurses to the field of battle, where they will be under the direction of military chiefs." These civil surgeons and nurses are to wear the white armlet with a red cross upon it (the brassard).

The proposed report of your honorable Committee gives a fair history of the origin of the Red Cross, with one or two exceptions, so we pass that without objection.

On page eight your Committee, or one of the Committee, refers to an article which he had written many years before, in which he then stated that civil aid was greatly detrimental to active military service, and after all these years he had not changed his opinion. We give the substance of his words, not the words themselves.

The gentleman is very unfortunate in his researches and observations. Thousands of men could have given unqualified indorsement to the civil aid in the Crimean war, rendered by that heroine, Florence Nightingale, and her devoted helpers. Tens of thousands of suffering men in our terrible civil war were saved from awful death by civil aid, voluntarily given, by associations and individuals, by the Sanitary and Christian Commissions.

In every war since the adoption of the Red Cross Treaty by the nations of the world, civil aid has saved thousands of lives and rendered relief and prevented untold suffering.

Your Committee pays great and well-deserved praise to the Geneva Convention, and its wisdom in adopting a universal sign, by which the nations of the world will recognize and respect the workers in the relief of suffering, but, may we dare to hope, that the death-blow which, in the same paragraph, you strive to deal the voluntary aid associations, was inadvertent, unintentional, and not with malice aforethought? On page two of your report, after stating that the brassard protects the Army Medical Service on fields of battle from intentional injury, capture, or imprisonment, are these

words, "To the Military Surgeons this was a grand achievement of the Convention of Geneva. It was independent of the establishment of civilian aid associations, or of any assistance either in personnel or material to be furnished by such associations. * * * * With the present efficient organization and discipline of Medical Staff Corps and the liberal appropriation for supplies, characteristic of the present time, it is believed that they will ordinarily be competent to do their work on the battle-field without civilian assistance.

M. Fregier, writing on this subject a few years since, said, "At every period, and amongst all nations, the personnel and material of the army medical departments, or the corps analogous to these, charged with the care and transport of the victims of war, *have been insufficient*. This is an *undisputed* and *incontestable* fact, written on every page of the world's military annals."

In every war the medical service has been inadequate, but through no fault of the physicians — a misfortune rather than a fault.

Civil aid for military necessity called the Red Cross into existence thirty years ago, and civil aid for military necessity has proved the greatest blessing to every warring nation since that time.

After a heavy battle, where hundreds and thousands of wounded and dying men lie scattered over miles of country, it is simply impossible for any army medical corps, however efficient, with all the appliances known to medical and surgical science, with all the nurses, ambulances, and stretcher-bearers that ever attended on a battle-field, to promptly relieve suffering; and every army surgeon knows that if prompt service could have been given, hundreds and thousands of precious lives could have been saved.

Civil aid for military necessity proves itself invaluable at such a time, if at no other.

President Moynier forever settles the question as to whether the Geneva Convention intended that civil aid societies should be in active operation with the military in this manner. "The societies have no fear, indeed, of being to a certain extent militarized; it is only on this condition that its co-operation will be acceptable, for a general can not accept the services of auxiliaries who only obey their own caprice; and, besides, a salutary discipline is absolutely indispensable. But they ought energetically to claim the right to

intervene whenever the official service is inadequate, even though it be on the field of battle, *as it is for this very object they were formed, with the approval of the whole world.* It would detract considerably from their influence, and perhaps deal a death blow, were they to be confined within a sphere too narrow. * * *" i. e., simply gathering supplies and attending, in a small way, to the wants of the sick and wounded in rear hospitals.

By order of the Board of Directors.

[Signed] GEORGE H. PULLMAN, *Secretary.*

THE AMERICAN ASSOCIATION OF THE RED CROSS.

The undersigned, all of whom are citizens of the United States of America, and a majority of whom are citizens of the District of Columbia, desirous of forming an association for benevolent and charitable purposes to co-operate with the Comité International de Secours aux Militaires Blessés of Geneva, Switzerland, do, in pursuance of Sections 545, 546, 547, 548, 549, 550, and 551 of the Revised Statutes of the United States, relating to the District of Columbia, make, sign, and acknowledge these

ARTICLES OF INCORPORATION.

I. — The name of this Association shall be The American Association of the Red Cross.

II.— The term of its existence shall be for twenty (20) years.

III. — The objects of this Association shall be —

1. To secure by the United States the adoption of the treaty of August 22, 1864, between Italy, Baden, Belgium, Denmark, Holland, Spain, Portugal, France, Prussia, Saxony, Würtemberg, and the Federal Council of Switzerland.

2. To obtain recognition by the Government of the United States, and to hold itself in readiness for communicating therewith at all times, to the end that its purposes may be more wisely and effectually carried out.

3. To organize a system of national relief, and apply the same as mitigating the sufferings caused by war, pestilence, famine, and other calamities.

4. To collect and diffuse information touching the progress of mercy, the organization of national relief, the advancement of sanitary science, and their application.

5. To co-operate with all other similar national societies for the furtherance of the articles herein set forth, in such ways as are provided by the regulations governing such co-operation.

IV. — The number of this Association, to be styled the "Executive Board," for the first year of its existence, shall be eleven (11).

In witness whereof, we have hereunto set our hands and seals at the city of Washington, this first day of July, A. D. 1881.

CLARA BARTON. [L. S.]
WILLIAM LAWRENCE. [L. S.]
JOS. K. BARNES. [L. S.]
A. S. SOLOMONS. [L. S.]
ALEX. Y. P. GARNETT. [L. S.]

UNITED STATES OF AMERICA, } ss:
DISTRICT OF COLUMBIA, }

I, R. D. Mussey, a United States Commissioner in and for the District of Columbia, hereby certify: That Clara Barton, William Lawrence, Jos. K. Barnes, A. S. Solomons, and Alex. Y. P. Garnett, subscribers to the annexed and foregoing articles of incorporation, being personally well known to me to be the persons who signed and sealed the same, personally appeared before me, in the District aforesaid, and acknowledged the said articles of incorporation to be their free act and deed for the purposes therein set forth.

Given under my hand and seal at the city of Washington, D. C., this first day of October, A. D. 1881.

R. D. MUSSEY,
U. S. Commissioner, D. C.

[L. S.]

OFFICE OF RECORDER OF DEEDS, DISTRICT OF COLUMBIA.

I hereby certify that the within and preceding articles of incorporation of the "American Association of the Red Cross" were received for record at my office aforesaid on the seventh (7th) day of October, A. D. 1881, at three (3) o'clock P. M., and were duly recorded in Liber "Incorporations No. 3," folio 191 *et seq.*, one of the land records for the District of Columbia, and examined by

FREDERICK DOUGLAS,
Recorder.

CERTIFICATE OF INCORPORATION OF THE AMERICAN NATIONAL RED CROSS.

KNOW ALL MEN BY THESE PRESENTS, That we, Clara Barton, Julian B. Hubbell, Stephen E. Barton, Peter V. DeGraw, and George Kennan, all being persons of full age, citizens of the United States, and a majority residents of the District of Columbia, being desirous of forming an association to carry on the benevolent and humane work of the "Red Cross" in accordance with

the Articles of the International Treaty of Geneva, Switzerland, entered into on the 22d day of August, 1864, and adopted by the Government of the United States on the 1st day of March, 1882, and also in accordance with the broader scope given to the humane work of said treaty by "The American Association of the Red Cross," and known as the "American Amendment," whereby the sufferings incident to great floods, famines, epidemics, conflagrations, cyclones, or other disasters of national magnitude, may be ameliorated by the administering of necessary relief; and being desirous of continuing the noble work heretofore performed by "The American Association of the Red Cross," incorporated in the District of Columbia for the purpose of securing the adoption of the said Treaty of Geneva by the United States, for benevolent and charitable purposes, and to co-operate with the Comitè International de Secours aux Militaires Blessés.

Now, therefore, For the purpose of creating ourselves, our associates and successors, a body politic and corporate in name and in fact: We do hereby associate ourselves together under and by virtue of Sections 545, 546, 547, 548, 549, and 550 of the Revised Statutes of the United States, relating to the District of Columbia, as amended and in force at this time; and do make, sign, and acknowledge this Certificate of Incorporation as follows, to wit:

FIRST.—The name by which this Association shall be known in law is: "The American National Red Cross."

SECOND.—The principal office of the Association shall be in the city of Washington, District of Columbia.

THIRD.—The term of its existence shall be fifty years from the date of this certificate.

FOURTH.—The objects of this Association shall be, in addition to the purposes set forth in the above preamble, as follows, to wit:

1. To garner and store materials, articles, supplies, moneys, or property of whatsoever name or nature, and to maintain a system of national relief, and administer the same in the mitigation of human suffering incident to war, pestilence, famine, flood, or other calamities.

2. To hold itself in readiness for communicating and co-operating with the Government of the United States, or any department thereof, or with the "Comitè International de Secours aux Militaires Blessés," of Geneva, Switzerland, to the end that the merciful provisions of the said "International Treaty of Geneva" may be more wisely and effectually carried out.

3. To collect and diffuse information concerning the progress and application of mercy; the organization of national relief; the advancement of sanitary science, and the training and preparation of nurses or others necessary in the application of such work.

4. To carry on and transact any business, consistent with law, that may be necessary or desirable in the fulfillment of any or all of the objects and purposes hereinbefore set forth.

FIFTH.—The affairs and funds of the corporation shall be controlled and managed by a Board of Directors, and the number of the Directors for the first year of the Corporation's existence, and until their successors are law-

fully elected and qualified, is five, and their names and addresses are as fol-fows, to wit:

Clara Barton, Washington, D. C.; Peter V. DeGraw, Washington, D. C.; Dr. Julian B. Hubbell, Washington, D. C.; Dr. Joseph Gardner, Bedford, Indiana, and Stephen E. Barton, Newtonville, Massachusetts.

The names and addresses of the full membership of the Association, who shall be designated as Charter-members, are as follows, to-wit:

Clara Barton, Washington, D. C.; Adolphus S. Solomons, Washington, D. C.; Peter V. DeGraw, Washington, D. C.; George Kennan, Washington, D. C.; Dr. Julian B. Hubbell, Washington, D. C., Col. Richard J. Hinton, Washington, D. C.; Mrs. Henry V. Boynton, Washington, D. C.; Rev. Rush R. Shippen, Washington, D. C.; Rev. Alex. Kent, Washington, D. C.; Rev. William Merritt Ferguson, Washington, D. C.; Gen. Edward W. Whitaker, Washington, D. C.; Joseph E. Holmes, Washington, D. C.; Mrs. Peter V. DeGraw, Washington, D. C.; Mrs. George Kennan, Washington, D. C.; Mrs. R. Delaven Mussey, Washington, D. C.; Mrs. Omar D. Conger, Washington, D. C.; William Lawrence, Bellefontaine, O.; Walter P. Phillips, New York, N. Y.; Joseph Sheldon, New Haven, Conn., John H. Von Wormer, New York, N. Y.; Albert C. Phillips, New York, N. Y.; Mrs. Walter P. Phillips, New York, N. Y.; Mrs. Joseph Gardner, Bedford, Ind.; Dr. Joseph Gardner, Bedford, Ind.; Miss Mary E. Almon, Newport, R. I.; Dr. Lucy Hall-Brown, Brooklyn, N. Y.; John H. Morlan, Bedford, Ind.; and Stephen E. Barton, Newtonville, Mass.; But the Corporation shall have power to increase its membership in accordance with by-laws to be adopted.

In witness thereof, we have hereto subscribed our names and affixed our seals in triplicate, in the city of Washington, District of Columbia, this, the 17th day of April, A. D. 1893.

CLARA BARTON.
JULIAN B. HUBBELL.
STEPHEN E. BARTON.
P. V. DEGRAW.
GEORGE KENNAN.

Witnesses:
S. G. HOPKINS.
F. H. SMITH.

DISTRICT OF COLUMBIA, TO WIT:

I, S. G. Hopkins, a Notary Public in and for the said District of Columbia, do hereby certify that Clara Barton, Julian B. Hubbell, Stephen E. Barton, Peter V. DeGraw, and George Kennan, whose names are signed to the foregoing and annexed "Certificate of Incorporation of the American National Red Cross," bearing the date of April 17, A. D. 1893, personally appeared before me, in the said District of Columbia, the said Clara Barton, Julian B. Hubbell, Stephen E. Barton, Peter V. DeGraw, and George Kennan, being personally well known to me as the persons who executed the said certificate, and each and all acknowledged the same to be his, her, and their act and deed for the purposes therein mentioned.

Given under my hand and official seal this 17th day of April, A. D. 1893.

S. G. HOPKINS,
Notary Public.

CONSTITUTION AND BY-LAWS OF THE ASSOCIATION OF MILITARY SURGEONS OF THE UNITED STATES.

PREAMBLE.

The military surgeons of the United States, in order to promote and improve the science of military surgery, have associated themselves together and adopted the following Constitution and By-Laws :

CONSTITUTION.

ARTICLE I.

Name.

The organization shall be known as " The Association of Military Surgeons of the United States."

ARTICLE II.

Members.

SECTION 1. There shall be active, associate, honorary, corresponding, and life members.

Active Members.

SEC. 2. Commissioned medical officers of the United States Army, of the Navy, and of the National Guard, or Volunteer Militia of the several States are eligible for active membership. Active members may retain their membership should they be honorably discharged

from the service in which they were commissioned. Active members only shall be eligible for office or entitled to vote.

Associate Members.

SEC. 3. Ex-medical officers and other officers of either of the above-mentioned services, and of the Marine Hospital Service, and ex-medical officers of the United States Volunteer Service are eligible for associate membership.

Honorary Members.

SEC. 4. Persons who are not qualified for active membership, but who have achieved distinction in the military service, are eligible as honorary members.

Corresponding Members.

SEC. 5. Military surgeons living outside of the United States, who are prominent in the literature of military medicine and hygiene, are eligible as corresponding members.

Life Members.

SEC. 6. On payment of the sum of $50.00 any active member may become a life member and be exempt from further dues.

ARTICLE III.

OFFICERS AND COMMITTEES.

Officers.

SEC. 1. The officers shall be a President, two Vice-Presidents, a Secretary, a Treasurer, and an Editor, who shall hold their respective offices until their successors are elected and qualified.

Committees.

SEC. 2. There shall be the following standing committees: An Executive Committee, to consist of the officers and ex-presidents and five (5) members. A Publication Committee, to consist of three (3) members. A Literary Committee, to consist of three (3) members of the National Guard or Militia, and one (1) each from the Army and Navy. A Nominating Committee, based upon a representative, or one vote, for each State or Territory, the Army, and the Navy, and for every additional ten (10) members or major fraction thereof, an extra representative or vote; said vote or votes to be cast by a member or members present from each State, Territory, Army, and Navy, to be designated by the members present from each State, Territory, Army, and Navy at the time of the meeting.

ARTICLE IV.

Quorum.

Thirty-five (35) members shall constitute a quorum for the transaction of business, but a less number may adjourn.

ARTICLE V.

Amendments.

All amendments to this Constitution and By-Laws shall be proposed in writing at one annual meeting, and voted on at the next. A three-fourths vote of all the members present at the annual meeting shall be necessary for adoption.

BY-LAWS.

ARTICLE I.

Election to Membership.

SEC. 1. Election to active or associate membership shall be by the Executive Committee, to whom the Secretary shall refer all applications, together with such credentials as may be presented.

SEC. 2. Election to honorary or corresponding membership shall be by a two-thirds vote of the Association, after the unanimous recommendation of the Executive Committee.

ARTICLE II.

Loss of Membership.

Any member who may be dismissed from the service for conduct unbecoming an officer and a gentleman shall be expelled and debarred from any further rights or privileges when proper proof has been furnished the Secretary.

ARTICLE III.

Meetings.

The Association shall meet annually, the time and place to be fixed at each meeting for the one ensuing. Special meetings may be called by the President at any time. At the annual meeting the President, Vice-Presidents, Secretary, Treasurer, and Editor shall be elected for the term of one year, the standing committees appointed, and the annual reports received.

ARTICLE IV.

Dues.

The dues to be paid by active and associate members shall be five dollars ($5.00), due at the time of election; thereafter on January 1

of each year, in advance, Delinquents in the payment of dues will not be entitled to the Proceedings or other publications of the Association.

Delinquency for two years shall terminate membership, after due notice by the Treasurer.

Honorary, corresponding, and life members shall be exempt from the payment of dues.

ARTICLE V.

DUTIES OF OFFICERS.

The President.

SEC. 1. The President shall preside at all meetings, appoint all committees, unless otherwise provided for, approve all proper bills, and perform such other duties as are usually incumbent upon such an officer.

The Vice-Presidents.

SEC. 2. The Vice-Presidents, in order of seniority, shall perform the duties of President in the absence or inability of that officer.

The Secretary.

SEC. 3. The Secretary shall keep the records and archives, issue certificates of membership to honorary and corresponding members on election, to active and associate members when notified by the Treasurer that the proper dues have been paid.

He shall present to the Committee on Publications a synopsis of the proceedings, and such papers as the authors desire to have published by the Association. He shall receive all applications for membership and refer the same to the Executive Committee. He shall notify the Treasurer of the election of active and associate members, and shall prepare an annual report. At each annual meeting he shall appoint an Assistant Secretary.

The Treasurer.

SEC. 4. The Treasurer shall receive all moneys due the Association, collect all assessments, and pay all bills which have been properly approved. He shall have charge of all publications, and distribute the same to those who are entitled to them. He shall notify the Secreatry when new active and associate members have paid and are entitled to certificates of membership.

The accounts of the Treasurer shall be audited by a committee appointed for that purpose on or before the annual meeting. He shall present an annual report.

He shall execute such a bond of $2,000 as may be approved by the Executive Committee for the faithful performance of his duties; the Association to bear the cost of this insurance.

The Editor.

SEC. 5. The Editor shall prepare for publication and see through the press all material furnished him by the Publication Committee. All contracts for printing must first have the approval of the President and Treasurer.

ARTICLE VI.

DUTIES OF COMMITTEES.

The Executive Committee.

SEC. 1. The Executive Committee shall perform the duties prescribed by the Constitution and By-Laws, and such other administrative or executive duties as may be referred to it, and for which provision has not otherwise been made. The President shall be *ex officio* chairman.

The Publication Committee.

SEC. 2. The Publication Committee shall determine what portions of the proceedings are of sufficient general interest to be printed.

It shall also decide on the advisability of publishing the various papers presented at the annual meeting, and forward all such ma-

terial to the Editor, and all papers presented to and accepted by the Association shall be its property, and shall not be published in any other form, except by the authority of the Executive Committee, and shall be credited to the Association.

The Literary Committee.

SEC. 3. The Literary Committee shall outline the literary work for the annual meeting in advance, making the necessary arrangements for the reading and discussion of papers.

The Nominating Committee.

SEC. 4. The Nominating Committee shall, at the annual meeting, present a list of candidates for the various offices for the ensuing year.

The vote, or votes, of the Nominating Committee shall be cast by a member, or members, who shall be designated by the members present, from each State or Territory, the Army, and the Navy.

OFFICERS OF THE ASSOCIATION FROM ITS FIRST ORGANIZATION.

1891-92.

President — Nicholas Senn, Brig.-Gen. and Surg.-Gen., Wis.
Vice-President — Nelson H. Henry, Major and Surgeon, N. G. N. Y.
Second Vice-President — E. Chancellor, Lt.-Col., Med. Director, N. G. Mo.
Secretary — F. L. Matthews, Col. and Surg.-Gen., N. G. Ill.
Cor. Secretary — Ralph Chandler, Lieut. and Asst.-Surg., L. A., N. G. Wis.
Treasurer — Francis J. Crane, Col. and Surg.-Gen., Col.
Chairman Com. of Arrangements for 1892 — Lieut.-Col. E. Chancellor.
First annual meeting was held at Chicago, Ill., September 17 and 18, 1891.

1892-93.

President — Nicholas Senn, Col. and Surg.-Gen., N. G. Ill.
Honorary President—C. R. Greenleaf, Lt.-Col. and Dpty Surg.-Gen., U. S. A.
Vice-President — Nelson H. Henry, Major and Surgeon, N. G. N. Y.
Second Vice-President —C. M. Woodward, Lt.-Col. and Surg.-Gen., Mich.
Secretary — E. Chancellor, Lt.-Col. and Med. Director, N. G. Mo.
Cor. Secretary — Ralph Chandler, Lt. and Asst. Surg., L. A., N. G. Wis.
Treasurer — Francis J. Crane, Col. and Surg.-Gen., N. G. Col.
Chairman Com. of Arrangements for 1893—Capt. Chas. Adams, Chicago.
The second annual meeting was held at St. Louis, Mo., April 19, 20, and 21, 1892.

1893-94.

President — Nicholas Senn, Col. and Surg.-Gen., N. G. Ill.
Vice-President — B. J. D. Irwin, Col. and Asst. Surg.-Gen., U. S. A.
Second Vice-President —Louis W. Read, Col. and Surg.-Gen., N. G. Pa.
Secretary — E. Chancellor, Lt.-Col. and Med. Director, N. G. Mo.
Assistant Secretary — Julian M. Cabell, Capt. and Asst. Surg., U. S. A.
Treasurer — Lawrence C. Carr, Major and Surg., N. G. Ohio.
Chairman Com. of Arrangements for 1894 — Geo. Henderson, Major and Surg.-Gen., D. C.

1894-95.

President — George M. Sternberg, Brig.-Gen. and Surg.-Gen., U. S. A.
Vice-President — Louis W. Read, Col. and Surg.-Gen., N. G. Pa.
Second Vice-President —Albert L. Gihon, Med. Director, U. S. Navy.
Secretary — E. Chancellor, Lt.-Col. and Med. Director, N. G. Mo.
Assistant Secretary — Julian M. Cabell, Capt. and Asst. Surg., U. S. Army.
Treasurer — Lawrence C. Carr, Major and Surg., N. G. Ohio.
Chairman Com. of Arrangements for 1895 — Albert H. Briggs, Major and Surg., N. G. N. Y.

REGISTER OF MEMBERS.

REVISED TO INCLUDE JANUARY 1ST, 1896.

ACTIVE MEMBERS.

Abbe, Ed. Harper, lt. (j. s.) and asst. surg., Mass. v. m., 405 County, New Bedford.
Adair, Geo. W., major and surg., U. S. A. .... Washington Barracks, D. C.
Adams, Chas F., 1st lt. and asst. surg., n. g. N. J. . Hackensack, N. J.
Allen, Gardner W., lt.-com. and surg., M. v. m. . . 90 Charles St., Boston, Mass.
Almy, Leonard B., lt.-col., med. dir., n. g. Conn. . . 173 Washington, Norwich.
Ames, Howard Emerson, surg., U. S. N. .... Washington, D. C.
Altree, Geo. H., act'g asst. surg., M. H. S. .... Port Tampa, Fla.
Anderson, Frank, surg., U. S. N. .... Washington, D. C.
Anthony, Frank, major and surg., n. g. Ill. .... First Ave., Sterling, Ill.
Appel, A. H., capt., asst. surg., U. S. A. .... Ft. Sheridan, Ill.
Appel, Dan'l M., major and surg., U. S. A. .... Ft. Porter, N. Y.
Arnold, Herbert A., lt. and asst. surg., n. g. Pa.... Ardmore, Pa.
Arnold, Will Ford, p. a. surg., U. S. N. .... Washington, D. C.
Ashenfelter, W. J., major and surg., n. g. Pa. .... Pottstown, Pa.
Bache, Dallas, col. and asst. surg.-gen., U. S. A. . . Omaha, Neb.
Bailey, Fred. D., capt. and asst. surg., N. Y. .... Brooklyn, N. Y.
Baker, John W., past asst. surg., U. S. N. .... Boston, Mass.
Baker, Washington H., major and surg., n. g. Pa. . Phila., Pa.
Balch, Lewis, major and surg., n. g. N. Y. .... Albany, N. Y.
Baldridge, Felix E., 1st lt. and asst. surg., n. g. Ala., Huntsville, Ala.
Barber, Geo. H., past asst. surg., U. S. N. .... Pensacola, Fla.
Banister, John M., capt., asst. surg., U. S. A. ..... Ft. Leavenworth, Kas.
Barker, C. F., major and surg., n. g. R. I. .... Newport, R. I.
Bates, Newton L., surg., U. S. N. .... Washington, D. C.
Beasley, Crawford D., 1st lt. and asst. surg., N. Y. . Brooklyn, N. Y.
Battle, Sam. W., major and asst. surg.-gen., N. C. . Asheville, N. C.
Belcher, Wm. N., capt. and asst. surg., n. g. N. Y. . Brooklyn, N. Y.
Bell, Robt. E., 2d lt. amb. corps, Mass. .... Lowell, Mass.
Benedict, John M., major and surg., n. g. Conn. ... Waterbury, Conn.
Bergen, Andrew C., major and surg., n. g. Iowa. . Sioux City, Iowa.
Bertolette, D. N., surg., U. S. N. .... Reading, Pa.
Birmingham, H. P., capt. and asst. surg., U. S. A. . . Ft. Trumbull, Conn.
Blackwood, N. J., past asst. surg., U. S. N. .... Yokohama, Japan.

Blood, Robt. A., lt.-col., Mass. v. m. . . . . 39 High St., Charleston, Mass
Boeckmann, Edw., lt.-col., asst. surg.-gen., Minn. . St. Paul, Minn.
Borden, Wm. Cline, capt. and asst. surg., U. S. A. . Ft. Snelling, Minn.
Bowen, Geo. A., brig. and surg.-gen., n. g. Conn. . Woodstock, Conn.
Boyd, J. C., surg., U. S. N. . . . . Washington, D. C.
Boyd, Robt., asst. surg., U. S. N. . . . . Philadelphia, Pa.
Bradbury, B. F., 1st lt. and asst. surg. . . . . Norway, Maine.
Brannen, Dennis J., capt. and asst. surg., n. g. Ariz. . Flagstaff, Ariz.
Briggs, Albert H., major and surg., n. g. N. Y. . . . . Buffalo, N. Y.
Bradley, Geo. P., surg., U. S. N. . . . . Mare Island, Cal.
Brooks, Wm. Allen, Jr., 1st lt. and asst. surg., Mass. v. m. . . . . 259 Beacon St., Boston, Mass
*Brown, J. Mills, surg., U. S. N. . . . . Washington, D. C.
Brown, Orlando J., 1st lt. and asst. surg., Mass. . . North Adams, Mass.
Brubaker, John I., 1st lt. and asst. surg., Penn. . . . Altoona, Pa.
Bryant, Giles W., major and surg., Mass. v. m. . . . Summerville, Mass.
Bunts, Frank E., capt. and asst. surg., n. g. Ohio. . Cleveland, O.
Budlong, John C., brig. and surg.-gen., R. I. . . . . . Providence, R. I.
Bryant, Jos. D., brig.-gen. and surg., n. g. N.Y. (ret.) . N. Y. City.
Büttner, Chas., major and surg., n. g. N. J. . . . . Orange, N. J.
Byers, Frederick W., brig. and surg.-gen., Wis. . . . Monroe, Wis.
Byrne, Chas. C., col. and asst. surg.-gen., U. S. A. . Governor's Island, N. Y.
Burrell, Herbert L., brig.-gen. and surg.-gen., Mass. (ret'd) . . . . Boston, Mass.
Beyer, H. G., surg., U. S. N. . . . . Washington, D. C.
Cabell, Julian M., capt. and asst. surg., U. S. A. . . . Davids Island, N. Y. Harbor.
Caldwell, Daniel G., major and surg., U. S. A. . . . . St. Francis Barracks, Fla.
Campbell, Wm. R., 1st lt. and asst. surg., n. g. N. Y. . Niagara Falls, N. Y.
Caswell, D. A., 1st lt. and asst. surg., n. g. Penn. . Scranton, Penn.
Carey, Chas. H., capt. and asst. surg., Wis. . . . . Darlington, Wis.
Carr, Geo. W., lt.-col. and med. dir., R. I. m. . . . . . Providence, R. I.
Carr, Lawrence C., major and surg., n. g. O. (ret'd) . . Cincinnati, O.
Carrington, Chas. V., capt. and asst. surg., Va. vol. . Richmond, Va.
Carter, Chas. C., major and surg., n. g. Ill. . . 1807 Fifth Ave., Rock Island, Ill.
Cassidy, Patrick, brig.-gen. and surg.-gen., Conn. . Norwich, Conn.
Cawley, M. F., 1st lt. and asst. surg., Pa. . . . . Allentown, Pa.
Chandler, Ralph, 1st lt. and asst. surg., n. g. Wis. . Milwaukee, Wis.
Chase, H. L., 1st lt. and asst. surg., Mass. v. m. . . . Brookline, Mass.
Clark, John E., lt.-col. and surg.-gen., Mich. . . . . . Detroit, Mich.
Clark, Thos. C., capt. and asst. surg., Minn. . . . . . . Stillwater, Minn.
Clendenin, Paul, capt. and asst. surg., U. S. A. . . . Ft. Warren, Mass.
Cole, Chas. M., 1st lt. and asst. surg. R. I. m. . . . . . 250 Broadway, Newport.
Collins, Daniel B., major and surg., Minn. . . . . St. Peter, Minn.
Cook, Chas. P., asst. surg.-gen., n. g. N. Y. . . . . Hudson, N. Y.
Cook, Frank Clarendon, asst. surg., U. S. N. . . . . . Ft. Monroe, Va.

*Deceased.

Cook, Geo., brig.-gen., n. g. N. H. (retired) .... Concord, N. H.
Corwin, Richard W., asst. surg.-gen., Col......... Pueblo, Col.
Crowell, Geo. B., 1st lt. and asst. surg., Conn..... Bridgeport, Conn.
Craig, Thomas C., past asst. surg., U. S. N..... .Navy Yard, N. Y.
Crandall, Rand P., past asst. surg., U. S. N....... San Francisco, Cal.
Crego, F. L., major, n. g. N. Y.................... 469 Delaware Ave., Buffalo.
Crispell, Chas. W., 1st lt. and asst. surg., n. g. N. Y.. Rondout, N. Y.
Currier, Edward H., lt.-col. med. div., n. g. N. H.. Manchester, N. H.
Dawson, Lewis R., major and surg., n. g. Wash... Seattle, Wash.
Day, Frank L., major and surg, R. I. m.......... Providence, R. I.
Dearing, H. S., 1st lt. and asst. surg.............. Boston, Mass.
Derr, Ezra, surg., U. S. N......................... Washington, D, C.
Devine, Wm. H., major and surg., Mass. v. m..... Boston, Mass.
Dixon, Charles H., major and surg., n. g. Mo..... St. Louis, Mo.
Dunn, Lewis D., lt. and asst. surg., n. g. Ill .... Moline, Ill.
Dutton, Chas. E., 1st lt. & asst. surg., n. g. Minn.. Minneapolis, Minn.
De Niedman, W. F., major and surg., n. g. Kas.... Pittsburg, Kas.
Eagleson, Jas. B., col. and surg.-gen., n. g. Wash.. Seattle, Wash.
Egle, Wm. H., major and surg., n. g. Pa.......... Harrisburg, Pa.
Edic, Guy L., capt. and asst. surg., U. S. A........ Washington, D. C.
Edwards, John B., major and surg., n. g. Wis..... Manston, Wis.
*Eggers, John T., capt. & asst. surg., n. g. Mo.. 11th & Walnut, Kansas City, Mo.
Emmerling, Karl A., 1st lt. & asst. surg., n. g. Pa.. Pittsburg, Pa.
Erwin, James J., capt. and asst. surg., n. g. O..... Cleveland, O.
Etheridge, James H., major and surg., n. g. Ill.... Chicago, Ill.
Ewen, Clarence, major and surg., U. S. A......... Los Angeles, Cal.
Evans, Theo. W., major and surg., n. g. Wis...... Madison Wis.
Farquhar, Emmer C., major and surg., n. g. Ohio.. Zanesville, O.
Festorazzi, Angelo, 1st lt. and asst. surg., s. g. Ala.. Mobile, Ala.
Fisher, Wm. H., a. a. surg., U. S. M. H. S......... Toledo, O.
Fitzgerald, Reynaldo J., major & surg., n. g. Minn.. Minneapolis, Minn.
Flagg, Geo. W., major and surg, n. g. N. H....... Keene, N. H.
Forin, Alex., 1st lt. and asst. surg., n. g. Minn.... St. Paul, Minn.
Forster, E. J., brig.-gen. & surg.-gen., Mass. v. m.. Boston, Mass.
Forwood, Wm. H., lt.-col. and dep. surg.-gen..... Washington, D. C.
Foster, Charles C., major and surg., Mass. v. m... Cambridge, Mass.
Foster, Romulus A., 1st lt. & asst. surg., n. g. D. C.. Washington, D. C.
Fowler, Geo. R., major and surg., n. g. N. Y...... Brooklyn, N, Y.
French, Chas. H., lt.-col. and med. dir., R. I. m... Pawtucket, R. I.
Fritts, Crawford E., 1st lt. and asst. surg......... Hudson, N. Y.
Fryar, James F., major and surg., n. g. s. Tenn... E. Nashville, Tenn.
Fuchs, Fred. L., 1st lt. and asst. surg., n. g. N. Y.. New York, N. Y.
Fuller, Chas. G., major and surg., n. g. Ill........ Chicago, Ill.
Fulton, John F., brig.-gen. and surg.-gen......... St. Paul, Minn.
Fulton, Wm. G., major and surg., n. g. Pa........ Scranton, Pa.

* Deceased.

Gandy, Charles M., capt. and asst. surg., U. S. A. . Washington, D. C.
Gallagher, Michael F., lt. and asst. surg., D. C. . . . Washington, D. C.
Gardner, Edwin F., capt. and asst. surg., U. S. A. . Fort Grant, Ariz.
Gates, Manley F., past asst. surg., U. S. N. . . . . Norfolk, Va.
Gannt, Franklin, lt.-col. and surg., n. g. N. J. . . . . . Burlington, N. J.
Geddings, Henry D., past asst. surg., U. S. N. . . . . McIntosh, Ga.
Giffen, Robt. F., col. and surg.-gen., Neb. (ret'd) . . Lincoln, Neb.
Gihon, A. L., med. dir. (Commo'e) U. S. N. (ret'd) . . N. Y. City.
Girard, Alfred C., major and surg., U. S. A. . . . . Ft. Douglas, Utah.
Glennan, James D., capt. and asst. surg., U. S. A. . Ft. Sill, Oklahoma Ter.
Godfrey, Chas. C., major and surg., n. g. Conn. . . . Bridgeport, Conn.
Godfrey, E. L. B., lt.-col., med. insp., n. g. N. J. . . . 400 Linden, Camden.
Godfrey, Guy C., 1st lt. and asst. surg., U. S. A. . . Ft. Russell, Wym.
Goode, Rhett, capt. and asst. surg., s. t. Ala . . . . . . Mobile, Ala.
Gottlieb, J. A., major and surg.-in-chief auxiliary military med. corps, n. g. N. Y. . . . . N. Y. City.
Grannis, Edw. H., capt. and asst. surg., n. g. Wis. . Menomonee, Wis.
Green, Chas. M., 1st lt. and asst. surg., Mass. v. m. . 78 Marlborough, Boston.
Green, Chas. O., asst. surg., n. g. N. Y. . . . . Hornellsville, N. Y.
Greenleaf, Chas. R., lt.-col., dep. surg.-gen., U. S. A. . San Francisco, Cal.
Griffith, J. D., brig.-gen., surg.-gen., n. g. Mo. (ret'd), Kansas City, Mo.
Guthrie, Joseph Alfred, past asst. surg., U. S. N. . Portsmouth, Va.
Gardner P., capt., U. S. A. . . . . Boston, Mass.
Hake, Wm. F., major and surg., Mich. . . . . Grand Rapids, Mich.
Halberstadt, Geo. H., 1st lt. & asst. surg., n g. Pa. . Pottsville, Pa.
*Halbert, J. E., col. and surg., n. g. Miss. . . . . Mound Landing, Miss.
Hall, Willie W., major and surg., n. g. Ohio. . . . . . . 72 E. High, Springfield, O.
Halley, Geo., major and surg., n. g. Mo. . . . . . 800 Lydia ave., Kansas City, Mo.
Hamilton, John B., surg., U. S. M. H. S. . . . Room 20, P. O. Bldg., Chicago, Ill.
Harland, Wm. Guy, 1st lt. and asst. surg., n. g. Pa. . Philadelphia, Pa.
Harman, Geo. C., 1st lt. and asst. surg., n. g. Pa. . 514 Penn, Huntingdon, Pa.
Harriman, John W., capt. and asst. surg., n. g. Ia. . Iowa City, Ia.
Harris, H. S. T., capt. and asst. surg., U. S. A . . . . Ft. Preble, Me.
Harvey, N. D., 1st lt. and asst. surg., R. I. m. . . . . 260 Benefit, Providence, R. I.
Harvey, P. F., major and surg., U. S. A. . . . . Plattsburg Barracks, N. Y.
Havard, Valery, major and surg., U. S. A. . . . . David's Island, N. Y.
*Hayes, Charles, lt.-col., med. dir., R. I. m. . . . . 3 Tobey, Providence, R. I.
Hendley, Franklin W., major and surg., n. g. O. . . Cincinnati, O.
Helm, Scott, col. and surg.-gen., Ariz. . . . . Phoenix, Ariz.
Henderson, Geo., major and surg.-gen., n. g. D. C. . 817 T st., Washington, D. C.
Henry, Nelson H., col. & asst. surg.-gen., n. g. N.Y. . 14 E. 10th, N. Y. City.
Hicks, Walter R., capt. and asst. surg., Mich. . . . 1700 State, Menominee, Mich.
Hodgman, A. F., 1st lt. and asst. surg., n. g. N. Y. . Auburn, N. Y.
Hoff, John Van R., major and surg., U. S. A. . . . . . Governor's Island, N. Y.
Hope, James P., p. a. surg., U. S. N. . . . . Pensacola, Fla.

* Deceased.

Hooper, Harrison C., capt. and asst. surg., n. g. Ill. . Chicago, Ill.
Hough, Charles P., brig.-gen. and surg.-gen., n. g. Mont. . . . . .36 E. Granite, Butte City, Mont.
Howard, Deane C., 1st lt. and asst. surg., U. S. A. . Ft. Custer, Mont.
Hudson, Fred. R., 1st lt. and asst. surg., n. g. N. Y. . Hoosack Falls, N. Y.
Hutton, W. H. H., act. asst. surg., U. S. M. H. S. . Detroit, Mich.
Ives, Francis J., capt. and asst. surg., U. S. A.. . . St. Francis Barracks, Fla.
Izlar, Roberts P., 1st lt. and asst. surg., Fla. . . . . . . 12 Ft. King Ave., Ocala, Fla.
Jackson, J. N., capt. and asst. surg., n. g. Mo . . . . . Kansas City, Mo.
Jacoby, William, lt. and asst. surg., n. g. Minn. . . . Mankato, Minn.
Jarrett, Arthur R., capt. and asst. surg., n. g. N. Y. . Brooklyn, N. Y.
Jarvis, N. S., capt. and asst. surg., U. S. A. . . . . David's Island, N. Y. H.
*Jessup, Robert B., col. and surg.-gen., n. g. Ind. . Vincennes, Ind.
Johnston, James, major and surg., n. g. Pa. . . . . Bradford, Pa.
Johnston, Wm. M., major and surg., n. g. Pa. . . . . . Lewickly, Pa.
Kaufman, F. J., 1st lt. and asst. surg., n. g. N. Y. . 4 Hier Flats, Syracuse, N. Y.
Keber, John B., 1st lt. and asst. surg., n. g. Mo. . . 919 Olive, St. Louis, Mo.
Keefer, Frank R., capt. and asst. surg., U. S. A. . . Washington Barracks, D. C.
Kendall, Wm. P., capt. and asst. surg., U. S. A. . . . Washington, D. C.
Kenyon, Geo. H., brig.-gen. and surg.-gen., R. I. m. . Providence, R. I.
Kilbourne, H. S., major and surg., U. S. A. . . . . Fort Clark, Tex.
Kimball, James P., major and surg., U. S. A . . . . . . Ft. Wingate, N. M.
Kirkpatrick, Thos., 1st lt. and asst. surg., Kas . . . . Westphalia, Kas.
Kling, Orlando, 1st lt. and asst. surg., n. g. Col . . . Denver, Col.
Kneedler, Wm. L., capt. and asst. surg., U. S. A. . Fort Mason, Cal.
Kulp, Jno. Stewart, 1st lt. and asst. surg., U. S. A . . Walla Walla, Wash.
Lacey, Irving E., capt. and asst. surg., n. g. Wis . . Neillsville, Wis.
La Garde, Louis A., capt. and asst. surg., U. S. A. . Boston, Mass.
La Pierre, Julian, major and surg., n. g. Conn. . . . . 220 Central, Norwich, Conn.
Le Conte, Robert, 1st lt. and asst. surg., n. g. Pa. . 1625 Spruce, Philadelphia.
*Leach, Hamilton E., capt. and asst. surg., n. g. D. C. . . . . 722 13th, N. W. Washington, D. C.
Leach, Philip, past asst. surg., U. S. N. . . . . Brooklyn, N. Y.
Lee, Edward W., col. and surg.-gen., Neb . . . . Omaha, Neb.
Lee, Simeon L., col. and surg.-gen., state Nev. . . . Carson, Nev.
Linthicum, John W., capt. and asst. surg., n. g. Md. 1327 W. Fayette, Baltimore, Md.
Lippincott, Henry, major and surg., U. S. A . . . . . . Ft. Sheridan, Ill.
Little, Frederick H., brig.-gen. and surg.-gen., n. g. Ia. (ret'd.) . . . . 116 W. Second, Muscatine, Ia.
Longshore, Wm. R., major and surg., n. g. Pa. . . . 71 Church, Hazelton, Pa.
Lopp, Wm. H., major and surg., n. g. Ind. . . . . . . 939 N. Alabama, Indianapolis.
Lydston, G. Frank, major and surg., n. g. Ill . . . . . 815 Reliance Bldg., Chicago.
McCaw, Wm. J., major and surg., R. I. m. . . . . 222 Benefit, Providence, R. I.
McCandless, A. E., lt.-col. and med. dir., n. g. Pa. . . Pittsburg, Pa.

*Deceased.

McCarthy, Wm. D., major and surg., n. g. Cal.....San Francisco, Cal.
McCulloch, C. C., 1st lt. and asst. surg., U. S. A...Fort Ringold, Tex.
McDill, John R., capt. and asst. surg., n. g. Wis..200 Wisconsin, Milwaukee.
McGill, John D., brig.-gen. and surg.-gen., N. J...126 Grand, Jersey City, N. J.
McGillicuddy, V. T., col. and surg.-gen., n. g.
S. Dak....................................Rapid City, S. Dak.
McKim, S. A. H., capt. and asst. surg., n. g. D. C...25 Fifth, S. E., Wash., D. C.
McKinstry, H L., major and surg., n. g. Minn..Main & Bush, Redwing, Minn.
* Macauley, C. N. B., capt. and asst. surg., U. S. A..Ft. Apache, Ariz.
Mann, Alban L., major and surg., n. g. Ill. (ret'd)..214 Chicago, Elgin, Ill.
Mann, Horace E., capt. and asst. surg., n. g. Wis..1520 Main, Marinette, Wis.
Marmion, Robert A., surg., U. S. N..............Washington, D. C.
Marsh, Wm. H., act. asst. surg., U. S. M. H. S.....Solomons, Md.
Martin, Edward, major and surg., n. g. Pa....415 S. 15th St., Philadelphia, Pa.
Martin, John M., 1st lt. and asst. surg., n. g. Pa..Grove City, Pa.
Mason, Charles F., capt. and asst. surg., U. S. A..West Point, N. Y.
* Matthews, Fred. L., col., surg.-gen., Ill........320 S. 5th St., Springfield, Ill.
Maus, Louis M., major and surg., U. S. A.........San Antonio, Tex.
Mead, Harry, capt. and asst. surg., n. g. N. Y..758 Elmwood Ave., Buffalo, N. Y.
Merrill, James C., major and surg., U. S. A.......Ft. Sherman, Idaho.
Meyer, Edward J., capt. and asst. surg., n. g. N. Y..1312 Main St., S. Buffalo, N. Y.
Meyer, Robt. C. J., ensign and asst. surg.........Moline, Ill.
Middleton, J. V. D., lt.-col., dep. surg.-gen., U. S. A..San Francisco, Cal.
Moore, H. McG. W., capt. and asst. surg., n. g. O..Columbus, O.
Morris, Lewis, asst. surg.........................Philadelphia, Pa.
Mudge, Selden J., 1st. lt. and asst. surg., n. g. N. Y..Olean, N. Y.
* Murphy, John H., brig.-gen. & surg.-gen., Minn..516 Jackson St., St. Paul.
Murray, R. P., surg., U. S. M. H. S...............Key West, Fla.
Myers, Charles F. W., lt.-col. and med. dir., N. J..Paterson, N. J.
Newgarden, Geo. J., 1st lt. and asst. surg., U. S. A..Ft. Yates, N. D.
Norton, Oliver D., past asst. surg., U. S. N.......Brooklyn, N. Y.
Ohmann-Dumesnil, A. H., 1st. lt. and asst. surg.,
n. g. Mo. (ret'd)...........................1 N. Broadway, St. Louis, Mo.
O'Meagher, Wm., major and surg., n. g. N. Y.....New York, N. Y.
O'Neal, James M., capt. and asst. surg., n. g. O....Norwich, O.
O'Neill, J. Wilks, major and surg., n. g. Pa......2110 Spruce, Philadelphia, Pa.
Owens, W. O., capt., U. S. A.....................Ft. Bayard, N. M.
Ottilie, Charles, act. asst. surg., U. S. M. H. S.....LaCrosse, Wis.
Parke, Chas. R., 1st lt. and asst. surg., n. g. Pa..332 Washington, Scranton, Pa.
Parker, W. J., 1st lt. and asst. surg., n. g. N. J.....Bergen Ave., Jersey City.
Parkhill, Clayton, col. and surg.-gen., Col........Denver, Col.
Patee, Eliphalet L., col. and surg., n. g. Kas. (ret'd)., Manhattan, Kas.
Penrose, Geo. H., major, asst. surg.-gen., med. dir..Salt Lake City, Utah.
Percy, Henry T., past asst. surg., U. S. N..........Washington, D. C.
Perley, Harry O., major and surg., U. S. A........Hot Springs, Ark.

*Deceased.

Persons, Remus Chas., U. S. N. . . . . .Portsmouth, Va.
Phillips, Frank I., act. asst. surg., U. S. M. H. S. .Escanaba, Mich.
Phillips, John L., capt. and asst. surg., U. S. A. . .Walla Walla, Wash.
*Pickman, H. D., brig.-gen. & surg.-gen., n. g. Mont., Dillon, Mont.
Pigott, Michael P., past asst. surg., U. S. N. . . . . . .Mare Island, Cal.
Pilcher, James E., capt. and asst. surg., U. S. A. . .Columbus Bks., Columbus, O.
Pinguard, Joseph, 1st lt. and surg., Okla. M. . . . . .Maeden, Mo.
Poindexter, Jeff. D., capt. and asst. surg., U. S. A. .Ft. Riley, Kas.
Porter, Joseph Y., major & surg., Fla. St. Hussars. .Jacksonville, Fla.
Potteiger, Jonathan B., major and surg., n. g. Pa. .Hamburgh, Pa.
Powell, Junius L., capt. and asst. surg., U. S. A. . .Jackson Barracks, La.
Priestley, James T., brig.-gen. and surg.-gen., Ia. .707 E. Locust, Des Moines, Ia.
Pritchett, Gilbert L., capt. and surg., n. g. Neb. . .Fairbury, Neb.
Purviance, W. E., 1st lt. and asst. surg., U. S. A. . .Ft. Sherman, Idaho.
Pyles, Richard A., capt. and asst. surg., n. g. D. C. .Washington, D. C.
Read, Louis W., col. and surg.-gen., n. g. Pa. . . . . .Norristown, Pa.
Reed, Walter, major and surg., U. S. A. . . . . .Washington, D. C.
Reyburn, Robt., late capt. & asst. surg., U. S. A. .2129 F, n. w., Washing'n, D. C.
Reynolds, Fred. P., 1st lt. and asst. surg., U. S. A. . .Ft. Sam Houston, Texas.
Rice, Chas. H., major and surg., Mass. v. m. . . . 12 Pritchard, Fitchburg, Mass.
Richards, Theo. W., asst. surg., U. S. N. . . . . . .Naval Dep't, Washington, D. C.
Richardson, William Lambert, major and surg.,
M. v. m. . . . . .225 Commonwealth ave., Boston, Mass.
Rixey, Presley M., surg., U. S. N. . . . . .Washington, D. C.
Robertson, Charles M., major and surg., n. g. Ia. .Davenport, Ia.
Robeson, Wm. F., lt.-col. and med. dir., n. g. Pa. .Pittsburg, Pa.
Robinson, Sam Q., capt. and asst. surg., U. S. A. .Philadelphia, Pa.
Rolfe, Wm. Alfred, 1st lt. & asst. surg., Mass. v. m. .5 Columbus sq., Boston.
Sanborn, Putnam P., capt. & asst. surg., n. g. Ind. .Angola, Ind.
Sawtelle, Henry W., surg., U. S. M. H. S. . . . . .New Orleans, La.
Sevey, H. S., capt. & asst. surg., n. g. S. D. (ret'd). .Mitchell, S. D.
Scofield, Walter K., med. dir., U. S. N. . . . . .League Island, Pa.
Shannon, Wm. C., capt. and asst. surg., U. S. A. . .Ft. Custer, Mont.
Shaw, John B., capt. and asst. surg., n. g. Ill. . . . . .Joliet, Ill.
Sherry, Henry, major and surg., n. g. Ill. .307 Alamo Plaza, San Antonio, Tex.
Shipp, Edward M., asst. surg. (ensign) U. S. N. .Naval Dep't, Washing'n, D. C.
Silliman, James E., major and surg., n. g. Pa. . . . .129 W. 6th, Erie, Pa.
Skinner, John O., major and surg., U. S. A. (ret'd). .Box 91, Chambersburg, Pa.
Smart, Charles, major and surg., U. S. A. . . . . .Washington, D. C.
Smith, Allen V., capt. and asst. surg., n. g. Ohio. .Canton, O.
Smith, French W., 1st lt. and asst. surg. . . . . .Omaha, Neb.
Smith, George T., past asst. surg., U. S. N. . . . . . .San Francisco, Cal.
Smith, L. S., 1st lt. & asst. surg., n. g. Pa. .2411 Delancey Pl., Philadelphia, Pa.
Smith, R. A., capt. & asst. surg., n. g. N. C. .Geo. & Chestnut, Goldsboro, N. C.
Smith, Wm. Loyd, major and surg., n. g. Ill. . . . . .Streator, Ill.

* Deceased.

Standish, Myles, capt. & asst. surg., M. v. m. . 6th st. & James av., Boston, Mass.
Stayer, Andrew S., major and surg., n. g. Pa. . . . . . 1121 Fifth Av., Altoona, Pa.
Steely, Oscar B., col. and surg.-gen., Idaho . . . . Pocatello, Idaho.
Sternberg, G. M., brig.-gen. and surg.-gen., U. S. A. . Washington, D. C.
Stewart, Walter S., 1st lt. and asst. surg. n. g. Pa. . Wilkesbarre, Pa.
Stiles, Henry R., 1st lt. and asst. surg., U. S. A. . . Ft. Meade, S. D.
Streeter, John Wm., major and surg., n. g. Ill. . . . . 2001 Prairie, Chicago, Ill.
Stunkard, Thos. C., major and surg., n. g. Ind. . . . 225 S. 5th, Terre Haute, Ind.
Taylor, Walter L., 1st lt., 22d Inf. (with regt.). . . . . Ft. Yates, S. D.
Terriberry, Geo. W., col. and div. surg., n. g. N. J. . 146 Broadway, Paterson, N. J.
Terry, M. O., brig.-gen. and surg.-gen. . . . . Utica, N. Y.
Tesson, Louis S., major and surg., U. S. A. . . . . Ft. Ethan Allen, Vt.
Thayer, Frederick C., col. and surg.-gen., Me. . . . . 119 Main, Waterville, Me.
Thomson, Arch. G., 1st lt. and asst. surg., n. g. Pa. . 1426 Walnut, Philadelphia.
Tilton, H. R., lt.-col. and dept. surg.-gen., U. S. A. . St. Paul, Minn.
Town, Francis L., col. and asst. surg.-gen., U. S. A. . San Antonio, Tex.
Townsend, J. H., 1st lt. and asst. surg., n. g. Conn. . 93 Howe, New Haven, Conn.
Trader, John W., major and surg., n. g. Mo. . . . . . 420 Osage, Sedalia, Mo.
Tuholske, Herman, major and surg., n. g. Mo. . . .
Jefferson and Locust, St. Louis, Mo.
Tuttle, Jay, act. asst. surg., U. S. M. H. S. . . . . Astoria, Ore.
Turnbull, Chas. S., major and surg., n. g. Pa. . 1719 Chestnut, Philadelplia, Pa.
Twitchell, H. E., capt. and asst. surg., n. g. O. . . . Hamilton, O.
Wakeman, Wm. J., capt. and asst. surg., U. S. A. . Fort Thomas, Ky.
Wallace, David L., major and surg., n. g. N. J . . 192 Clinton Av., Newark, N. J.
Wallace, H., capt and asst. surg., n. g. N. Y. . . . 183 Congress, Brooklyn, N. Y.
Ward, Jno. M. B., 1st lt. and asst. surg., n. g. Pa. . Marcus Hook, Pa.
Warren, Frank S., major and surg., v. m. Me. . . . . 17 South, Biddeford, Me.
Watson, James A., lt. and asst. surg., n. g. D. C. . . Washington, D. C.
Watson, W. S., 1st lt. and asst. surg., n. g. Conn. . 66 West, Danbury, Conn.
Weaver, Joseph K., major and surg., n. g. Pa. . . . . Norristown, Pa.
Wedge, Albert C., lt.-col. and asst. surg.-gen . . . . . Albert Lee, Minn.
Wertenbaker, Chas. P., past asst. surg., M. H. S. . Delaware Breakwater, Del.
Westerveldt, J. D., capt. and asst. surg., n. g. Tex. . Alice, Tex.
Wheaton, C. A., brig.-gen. and surg.-gen. (ret'd) . . 326 Wabash, St. Paul.
Wheaton, Robert A., 1st lt. and asst. surg., n. g. . . St. Paul, Minn.
Willcox, Charles, capt. and asst. surg., U. S. A. . . . West Point, N. Y.
Wiley, Charles C., major and surg., n. g. Pa . . . . . . 812 Penn, Pittsburg, Pa.
Wilkie, Fred. J., major and surg., n. g. Wis . . . . 61 Merritt, Oshkosh, Wis.
Willard, J. J., capt and asst. surg., n. g. Col. . . . . . . Pueblo, Col.
Wilson, John S., 1st lt. and asst. surg., n. g. N. Y. . 29 Grand Av., Poughkeepsie.
Wilson, Wm. W., capt. and asst. surg., n. g. Wis. . 620 Third, Wausau, Wis.
Wise, John C., surg., U. S. Navy . . . . Washington, D. C.
Wood, Leonard, capt. and asst. surg., U. S. A. . . . . Washington, D. C.
Wood, Marshall W., major and surg., U. S. A. . . . . Boise Barracks, Idaho.
Woodhull, Alfred A., lt.-col. and dep. surg.-gen.,
U. S. A . . . . Denver, Col.

Woodruff, Chas. E., capt. and asst. surg., U. S. A. . Ft. Sheridan, Ill.
Woods, George Worth, med. dir., U. S. N. . U. S. Naval Hosp, Mare Island, Cal.
Woodward, Chas. M., lt.-col., surg.-gen., n. g. Mich.
(retired) . . . . Tecumseh, Mich.
Worthington, James C., major and surg., U. S. A. . Vancouver Barracks, Wash.
Wright, Arthur L., major and surg., n. g. Ia. . . . . . Carroll, Ia.
Wyeth, M. C., capt. and asst. surg., U. S. A. . . . . . . Ft. McPherson, Ga.
York, George Wm., major and surg., n. g. N. Y . . . 190 Franklin, Buffalo, N. Y.

LIFE MEMBERS.

Adams, Charles, major and surg., n. g. Ill . . . . 206 28th st., Chicago, Ill.
Alden, Chas. H., col. and asst. surg.-gen., U. S. A. . Washington, D. C.
Chancellor, Eustathius, lt.-col. & med. dir., n. g. Mo., 613 Pine st., St. Louis, Mo.
Senn, Nicholas, col. and surg.-gen., n. g. Ill. . . . 532 Dearborn st., Chicago, Ill.

HONORARY MEMBERS.

*McClellan, Ely, lt.-col., deputy surg.-gen . . . . Chicago, Ill.
*Roth, William A., surg.-gen., Saxony . . . . Dresden.
Irwin, Bern. J. D., col. and asst. surg.-gen. (ret'd) . . Chicago, Ill.
Henrotin, Fernand, major and surg, n. g. Ill. . . . . . Chicago, Ill.
Sigwood, H. W., 1st lt. and asst. surg., Ia . . . . Anamosa, Ia.
Wyman, Walter, surg.-gen., U. S. M. H. S . . . . Washington, D. C.
Leighton, W. H., major and surg., soldier's home . . Milwaukee, Wis.
Barnes, Algernon S., brig.-gen. & surg.-gen., Mo . . St. Louis, Mo.
McIntyre, John H., major and Surg., n. g. Mo . . . . . St. Louis, Mo.
Miller, Truman W., major and surg., n. g. Ill. . . . . . Chicago, Ill.
Kimball, A. D., major and surg . . . . Marion, Ind.
Love, Isaac N., lt.-col. and med. dir., n. g. Mo . . . . St. Louis, Mo.
Grant, Thomas P., capt. and asst. surg., Ky . . . . . . Louisville, Ky.
Schuyler, Clarkson, 1st lt. and asst. surg . . . . Plattsburg.
Mills, Hiram R., lt.-col. and surg.-gen., Mich . . . . . Port Huron, Mich.
Book, James B., lt.-col. and surg.-gen., Mich. . . . . . Detroit, Mich.
Taneyhill, G. Lane, major and surg., n. g. Md . . . . Baltimore, Md.
Geib, Henry P., brig.-gen. and surg.-gen . . . . Stanford, Conn.
Brinton, John H., late surg. U. S. vols . . . . Philadelphia, Pa.
Bayles, George, major and surg . . . . Orange, N. J.
Tryon, J. Rufus, surg.-gen., U. S. N . . . . Washington, D. C.
Smith, J. R., col. & asst. surg.-gen., U. S. A. (ret'd) . . Seattle, Wash.
Moore, J., brig.-gen. & surg.-gen, U. S. A. (ret'd) . . Washington, D. C.
Page, Chas., col. & asst. surg.-gen., U. S. A (ret'd) . . Baltimore, Md.
Murray, R., brig.-gen. & surg.-gen., U. S. A. (ret'd) . . Washington, D. C.

* Deceased.

Flint, Austin, ex-surg.-gen. of New York.........New York, N. Y.
Keen, W. W., Prof. of Surgery...................Philadelphia, Pa.

ASSOCIATE MEMBERS.

O'Connor, Charles M., capt., 8th U. S. cav........Ft. Mead, S. Dak.
Rumbold, Frank M., capt., Bat. A, n. g. Mo......703 Olive, St. Louis, Mo.
Werts, George T., Governor of New Jersey.......Trenton, N. J.
Smith, James, Jr., U. S. Senator, New Jersey......Newark, N. J.
Cadmus, Cornelius A., Mem. Cong., 5th dist. N. J..Paterson, N. J.
Heppenheimer, Wm. C., brig.-gen. and insp.-gen., N. J., Jersey City, N. J.
Donnelly, Rich. A., brig.-gen. and q. m.-gen., N. J..Trenton, N. J.
Dyer, Elisha, brig.-gen. and adjt.-gen., R. I......Providence, R. I.
Moore, Milt., brig.-gen. comd. 1st brig., n. g. Mo..Kansas City, Mo.
Fox, George C., col. 7th Regt., 4th brig., n. g. N.Y..Buffalo, N. Y.
Truax, Charles, ...77 Wabash St., Chicago, Ill.
Doyle, Peter C., brig.-gen., n. g. N. Y...........Buffalo, N. Y.
Welsh, Sam'l J., Jr., col. 65th Regt., 4th brig. n. g..Buffalo, N. Y.
Brown, D. Russell, Governor of Rhode Island....Providence, R. I.
Kendall, Hiram, brig.-gen. com. brig., R. I.......Providence, R. I.
Weeks, Edson J., major 4th brig. staff, n. g.......Buffalo, N. Y.
Spencer, B. W., brig.-gen., inspt.-gen., r. p.......Passaic, N. J.
Harries, George, major, insp.-gen., r. p..... .....Washington, D. C.
Ordway, Albert, brig.-gen. com., n. g. D. C.......Washington, D. C.
Sander, Enno, major and brig.-gen., n. g. Mo.....125 S. 11th St., St. Louis, Mo.
Baker, John W., 2d lt., 3d Infantry................Ft. Snelling.
Brush, Edmund Cone, col., com. 1st Reg. Light
Art., n. g. O...................................Zanesville, O.
Younger, Wm. J., lt.-col. and med. dir., n. g. Cal..San Francisco, Cal.
Beall, Geo. T., capt., U. S. A.....................St. Louis, Mo.
Grove, John H., surg., U. S. vols.................Philadelphia, Pa.
Zier, Edward B...............................Minneapolis, Minn.

CORRESPONDING MEMBERS.

Finkler, Prof., staff surg., German Army.........Bonn, Germany.
Von Esmarch, surg.-gen., Germany..............Kiel.
Von Coler, Prof., surg.-gen., Prussia ....Berlin.
Von Bergman, surg.-gen., Germany..............Berlin.
Colin, Leon Jean, med. inspector-gen., France....Paris.
Mackinnon, Sir William, A. K. C. B., major-gen.
and gen. med. staff, Great Britain............London.
O'Neil, Sir J., C. B., surg.-gen. med. department,
India (ret'd).................................London.
Fevaud, Berenger, med. dir. marine med. service,
France.......................................Paris.

Von Lotzbeck, surg.-gen., Bavaria................Munich.
Podrazky, S., chief corps army surg., Austro-Hungary.................. ....Buda-Pesth.
Edholm, E. M., surg.-gen., Sweden..............Stockholm.
Timmerman, R., inspector-gen. army med. service, Netherlands..... ....Amsterdam.
Von Fichte, surg.-gen., Wurtemburg............Stuttgart.
Von der Linden, inspector-gen. army med. service, Belgium............... ....Brussels.
Ziegler, A., col., surg.-gen., Switzerland..........Bern.
Thaulow, J. F., major and surg.-gen., Norway.....Christiana.
Remert, ——, dir.-gen. army med. service, Russia..St. Petersburg.
Pecco, G., insp.-gen. army med. service, Italy.....Rome.
Thien, Hi, inspector-gen. army, Siam............Bangkok.
Bergin, Darby, M. P., surg.-gen., Canada.........Cornwall, Ont.
Ryerson, G. Sterling, surg. royal gren. of Canada..Toronto.
Strange, F. W., surg. I. S. C....................Toronto.

LIST OF OFFICIAL DELEGATES TO THE FIFTH ANNUAL MEETING.

UNITED STATES ARMY.

Lt.-Col. Dallas Bache, Deputy Surgeon-General, U. S. A., Omaha, Neb.
Major Philip F. Harvey, Surgeon, U. S. A., Plattsburg Barracks, N. Y.
Capt. Dan'l M. Appel, Assistant Surgeon, U. S. A., Ft. Porter, Buffalo, N. Y.

UNITED STATES NAVY.

Medical-Director Albert L. Gihon, U. S. N., Washington, D. C.
Surgeon J. C. Boyd, U. S. N., 1313 P Street, N. W., Washington, D. C.

COLORADO.

Colonel Clayton Parkhill, Surgeon-General of Colorado, Denver.

CONNECTICUT.

Brigadier-General George Austin Bowen, Surgeon-General, N. G. C.
Major John M. Benedict, Surgeon, 2d Regiment, N. G. C.

DISTRICT OF COLUMBIA.

Major George Henderson, Surgeon-General, N. G. D. C., Washington, D. C.

ILLINOIS.

Col. Nicholas Senn, Surgeon-General, N. G. I., 532 Dearborn St., Chicago.
Major Jas. H. Etheridge, Surgeon, N. G. I., 1634 Michigan Avenue, Chicago.
Major B. B. Griffith, Surgeon, N. G. I., Springfield, Ill.
Major C. C. Carter, Surgeon, N. G. I., Rock Island, Ill.

IOWA.

Brigadier-General James T. Priestly, Surgeon-General, Iowa, Des Moines.

KANSAS.

Major W. F. DeNiedman, Surgeon, N. G. K., Lacta, Pittsburg, Kas.

MASSACHUSETTS.

Brig.-General Edward J. Forster, Surgeon-General, Massachusetts, Boston.
Captain Myles Standish, Assistant Surgeon, M. V. M., Boston, Mass.

MICHIGAN.

Lt.-Col. Charles M. Woodward, Ex-Surg.-Gen., N. G. Mich., Tecumseh.

MISSOURI.

Brigadier-General J. D. Griffith, Ex-Surg.-Gen., N. G. Mo., Kansas City.
Lieutenant-Colonel Eustathius Chancellor, Med. Dir., N. G. Mo., St. Louis.

MONTANA.

Brigadier-General H. D. Pickman, Surgeon-General of Montana.

NEVADA.

Colonel Simeon L. Lee, Surgeon-General of Nevada, Carson City.

RHODE ISLAND.

Brigadier-General George H. Kenyon, Surgeon-General, Rhode Island.

TEXAS.

Colonel R. M. Swearingen, Surgeon-General of Texas.,
Captain St. Cloud Cooper, Assistant Surgeon, 1st Regiment.

VERMONT.

Brigadier-General James N. Jenne, Surgeon-General of Vermont.

WISCONSIN.

Brigadier-General Frederick W. Byers, Surgeon-General of Wisconsin.
Captain Horace E. Mann, Assistant Surgeon, N. G. W., Marinette.

INDEX.